THE HISTORY OF THE TYPEWRITER.

THE HISTORY OF THE TYPEWRITER:

Being an Illustrated . .
Account of the Origin,
Rise and Development
of the Writing Machine.

BY

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PREFACE.

THE greater portion of the present volume was put into type during the year 1907, but the constant stream of new machines which were put upon the market about that time led to the publication being deferred from time to time. As soon as particulars of one machine were obtained, and an opportunity taken to inspect it, other machines were announced, and in the desire to make the book, the only one of its kind in the English language, as complete as possible, it has been held over until now.

During the period which has elapsed since the work was undertaken, the structure of the typewriter has undergone a complete revolution. It seems impossible, at this time, to imagine that any further changes of a fundamental nature will take place for years to come, and that each succeeding machine will merely add to the procession of front strike typewriters, as illustrated in Chapter VIII, seems almost a foregone conclusion. Probably nothing in any mechanical art has been more marked than the progress of this principle, and in this respect the Underwood typewriter would seem to deserve all the honours which naturally fall to the successful leader of a revolution.

But although, so far as the broad lines of the machine are concerned, we are not likely, just at present, to see any radical changes, he would be an exceedingly rash prophet who would declare that typewriter skill had reached its limit. The gradual concentration of ideas upon a converging theory must tend to lead to considerable advances in matters of detail subservient thereto. Although machines employing the double keyboard, as well as the double shift-key, will long continue to hold their own in the competition now existing—and rightly so, since no machine has or ever will be invented which will meet the requirements of everyone—yet it is safe to say, without derogation to any machine, that those machines having the universal keyboard with one shift key are the most popular. The use of a universal ribbon, so far as width is concerned, now stands in marked contrast to the dozen widths used but very few years ago. The

principle of visible writing has now been adopted almost universally, as well as the introduction of bi-chrome ribbons. Every machine calling itself "standard" is now fitted with a built-in tabulator as part of the machine, without additional cost, whereas but say four or five years ago, this device would cost anything from two to five pounds additional; and the back space key, which is, without doubt, the most useful adjunct ever supplied to a typewriter, is found even on the lower priced instruments.

Development may therefore be looked for along the line of new uses and adaptations of the writing machine to purposes at this time not thought of, particularly in connection with invoicing, bookkeeping, etc. And various additional conveniences will necessarily be added in order to render the machine more and more suitable to these extended applications. Probably, we do not know, but probably an automatic carriage return may be one of the first improvements. A machine capable of using two styles of type, such as roman and italic, in conjunction with a compound shift key arrangement, might appeal to many people.

We quite expect that in this volume many little slips may be found. As far as it has been possible, every statement has been verified, and wherever a machine has been accessible, either in England or in our visits abroad, we have drawn the account of the machine from a personal inspection. We shall be glad to have particulars of any errors, as well as of machines not described herein, either new ones or old ones, or new models of old ones, and will acknowledge, gratefully, any such particulars.

We would like to add a word of acknowledgment to various sources of information. To certain publications of Mr. A. E. Morton, to the files of the Phonographic World, Typewriter Topics, Office Appliances, the Scientific American, and other publications (a complete list of which it is impossible to give for sheer lack of space) we are especially indebted. Many of the illustrations have been prepared from the roughest possible originals, and a word of thanks should therefore be given to the blockmakers, Messrs. André and Sleigh, Ltd., of Watford, as well as the printers, Messrs. Hunt, Barnard & Co., of Aylesbury, without whose assistance this book had never appeared.

THE AUTHOR.

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INTRODUCTION.

IT has been estimated, although the material for such purpose is generally admitted to be more or less obscure, that between two and three hundred thousand persons in Great Britain are able to earn a sufficient living wage by means of the typewriter. To this number may be added those (even more difficult to accurately enumerate) who employ writing machines for private purposes, either as ministers of religion, authors, journalists, travellers, and so on. Then, to increase the total, there are the salesmen and others engaged in the dissemination of the machine, and the necessary office, warehouse and mechanical staffs engaged by the various companies. Furthermore, the literature which this vast army of typewriter people calls into demand, finds employment, more or less constant, to very many other persons, so that, taking it all round, it is fairly safe to assume that no less than five hundred thousand of the total population of Great Britain are more or less connected with, or earn a living by, the writing machine.

Yet thirty years ago the typewriter was, to all intents and purposes, unknown in these realms. It was merely trying to get on its feet in what we may call—though as we shall see, with more courtesy than regard for the rigid truth—its own country. Now what a contrast is to be seen! Day by day fresh converts are made, week by week the number of offices increases in which the merry though often nerve-distracting click of the typewriter may be heard. It is gradually overcoming all obstacles, and the end is still far away.

Those who are best in a position to judge, have been heard to declare that even in America the typewriter is yet in its infancy. As commerce develops, and the tense nervous strain of city life increases, more machines than ever will be required to lighten the labours of those engaged in clerical work. And it is a strange sequence

of this demand, that as the call for manual handwriting decreases, the requirement for a better, more legible, and superior penmanship increases. The eyes, grown accustomed to the clearly marked characters of the typewriter, will no longer tolerate schoolboy scrawl, and, coincidentally with mechanical beauty, manual elegance will obtain a fresh lease of life, and the demand for a good handwriting become stronger and stronger.

Establishments for the sale of typewriters constantly increase in numbers. These, for the most part, are under the superintendence of educated and accomplished gentlemen, trained to a degree of expertness hardly to be matched in any other calling. The fitting up of typewriting offices is carried to a pitch of elegance and refinement in vividly marked contrast to that to be observed in many other quarters. The heads of these offices are generally willing to train any competent stenographer in the use of their machines, free of charge, or at the utmost for a purely nominal fee. They have reason for so doing, as it is frequently found that the greatest difficulty in selling typewriters is the delay which is often experienced in getting competent operators to work them. Hence it happens that the smart typist, whose shorthand is perfect, and whose general ability in other directions is sufficient to warrant him or her being placed in a position, can readily have the choice of good and remunerative employment.

The wages earned by typewriter operators, or typists, as it has become the fashion to call them, will necessarily be found to vary considerably, according to the amount of experience the typist possesses, to the extent of qualifications, and the generosity of the employers. A few firms offer very low wages indeed, but they do not expect, and do not get, the best hands. Taking it all round, one will not be wrong in asserting that the average remuneration of the shorthand typist is in excess of what the same person would receive, with a like amount of experience, in any other calling. It may be regarded, therefore, that, reckoning the highly paid along with the under paid, the typewriter, in addition to employing half a million persons, puts into the pocket of each an average of two pounds per week, so that the weekly paybill of the typists falls little, if anything, short of a million pounds per week, or say £50,000,000 sterling per annum.

In the land of its birth, or rather, let us say, in America, the typewriter shows up in even brighter colours. The Remington Company have made and sold at least a half

million machines. Then there are other makers. The numbers of typists in America it is impossible to estimate, but it is fairly safe to declare that three, four, or probably five machines are to be found in America for every single specimen here.

The capital involved in this mighty industry is probably between eight and nine million dollars. From a Return issued by the Census Department at Washington comparing the years 1890 and 1900, it appears that capital increased enormously, the amount paid for labour has also increased, and the value of the output also. But there is this to note. The amount of capital required, and the amount of labour put into a machine, is far heavier now than was the case in 1890. The following diagram, from the Return in question, will make this quite clear :

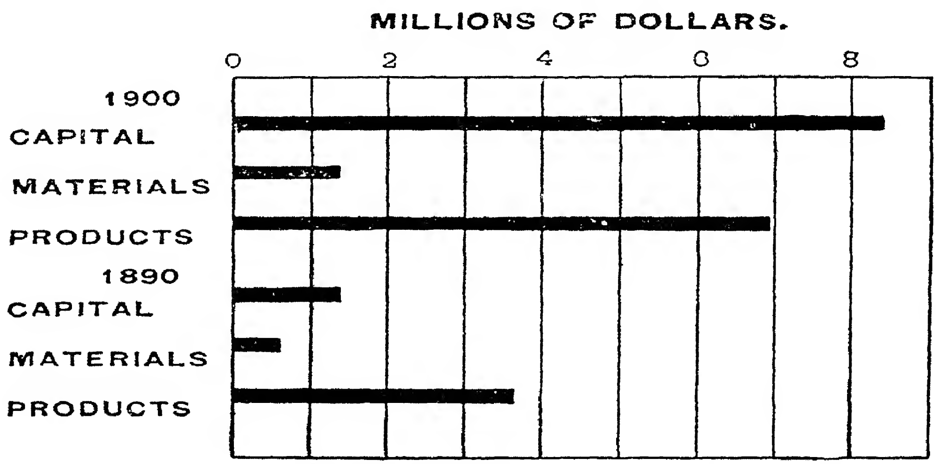


FIG I

The literature of the typewriter bears an even ratio to its immensity in other respects. Catalogues, instruction books, propaganda and other incidental literature increases in volume year by year. The quality of this literature is generally of the highest class. The commonest little booklet is well printed, generally illustrated, and tastefully got up. There is nothing, there *may* be nothing cheap or nasty about the typewriter, or it will fail absolutely to effect the purpose for which it is prepared. The collection of typewriter literature bids fair to become a cult, and in the near future, the almost forgotten handbill of-to-day will be as closely and eagerly sought for as a rare stamp is now.

For the typewriter is one of those products of skill which has exceeded all human anticipations. In the first place, it was introduced to be merely a substitute for the pen. Instead of holding the stylus as of old, the literary piano was to be played, and the tune it was to turn out was to be the typewritten document. But behold! this is now but the most elementary part of the art. It quickly became clear that two, three, or more copies could be typed simultaneously. Then the mimeograph or duplicator became known, and the duplicator and the typewriter between them threatened to operate as the greatest enemy to the jobbing printer. But if the typewriter and the duplicator, between them, take one job from the printer, they send two jobs to him. The surprising power of the typewriter is, that it tends to create new work, rather than divert work from other folk. Instead of killing the printers, it gives and finds them work. Instead of killing the pen-making trade, the pen-makers all use it in their offices. There is more ink used to-day than ever before. Paper, although economised in the typewriter, is produced in greater quantities than ever before in the history of the world, and so the merry click of the machine goes on, and on.

But even the power to turn out one, or say a thousand copies, did not discover the limitations of the powers of our marvellous machine. A slight addition to it, and the most difficult tabulated work became as easy of execution as any other class of work. Another happy thought, and the tabulator and the carbon sheet were combined in another device, and the day-book and invoice attachment permitted these two records to be made at one operation. Writers on office management, and bookkeepers all declare that the transcription of figures from one record to another is the most prolific source of errors, and so, at one swoop, this great pitfall was cleared away.

To write on a loose sheet of paper was one thing: to write in a bound book was, apparently, quite another. But, as we shall see, even in the very earliest and crudest efforts in the invention of the typewriter, the possibility of substituting the thickest volume the world contains for the paper ordinarily used required merely the thinking of: and later inventors have seized upon this, or some similar idea, and now book typewriters are known in the furthermost corners of the globe.

Typewriters have also been invented for purposes outside the usual objects sought by writing machines. Musical

typewriters, for instance, are not in such urgent demand, but they have been invented, and have attained quite a reasonable degree of perfection.

There has been one feature, too, in connection with the typewriter which will at once appeal to the kindly disposed and charitable. Almost, if not quite, from the first, the effort has been to produce a mechanical writer for the use of the blind. But this has opened out two branches of study, for in the first place, the sightless ones are able readily to operate ordinary machines for general purposes, whilst for intercommunication special instruments have been devised, using the Braille or other codes, and at least one of the instruments has been brought to such a degree of perfection, that it can be manipulated, as a shorthand machine, with a speed equal to that attained by the ordinary or average sighted stenographer. By means of this shorthand machine, and the ordinary typewriter, many blind shorthand clerks to-day earn an easy competency, who, but for these aids, might be thrown upon the cold charity of a hard-hearted world.

The great principle of the typewriter, that is to say, the depression of a key in order to produce a visible or tangible result, has also made itself manifest in several other ways. Such widely divergent instruments as the national cash register and the linotype composing machine must be considered as developments of the writing machine and this opinion will, it is considered, be regarded as fully justified when the account of these machines comes to be written.

Although the typewriter has been, from its first inception to the present day, purely practical, it has not been without its lighter side. It has done more than anything else to create uniformity in business matters and communications. It has rendered correct spelling a thing impossible to avoid. It has forced attention to the problems of punctuation. It has taught display, system, orderliness, and a due regard for little things. It has trained even the most careless operators in a more or less perfect school of mechanics. It has always proved itself a willing instrument in the hands of the intelligent operator. Little that can be done with the pen cannot be repeated with the typewriter. It is a training school of art, the lightning caricaturist, the pencil of nature, and the portrait painter *par excellence*. Numerous specimens of artistic work have been published, every line of which has been produced on the typewriter, and the studies appended to this introduc-

tion yield ample proof of all that has been claimed for the writing machine.

FLOWER STUDY

EXECUTED ON A WILLIAMS TYPEWRITER

FIG. 2

QUEEN VICTORIA

Executed on an Oliver Typewriter.

Fig. 3

NORWICH 3. FEBRUARY 1846

GENT.

WE HAVE, AT LENGTH COMPLETED ONE OF THURBERS MECHANICAL CHIROGRAPHERS. ALTHOUGH YOU WILL NOTICE IMPERFECTIONS IN THE FORMATION OF THE LETTERS IN THIS COMMUNICATION, YET THERE IS NOT A SINGLE DEFECT WHICH DOES NOT ADMIT OF AN EASY AND PERFECT REMEDY. I AM PERFECTLY ~~SATISFIED WITH IT BECAUSE I DID NOT LOOK FOR I~~ PERFECTION IN THIS FIRST MACHINE. THE DIFFICULTY IN THIS MACHINE IS THAT THE CAMS ARE NOT LARGE ENOUGH. THIS, OF COURSE, CAN BE AVOIDED. I THINK MR. KELLAR TOLD WHEN I LAST SAW HIM THAT IF I WOULD WRITE TO HIM INFORMING HIM WHEN I SHOULD BE IN WASHINGTON HE MIGHT BE ABLE TO MAKE SOME SUGGESTIONS ABOUT A HOME DURING ~~MY~~ STAY IN WASHINGTON. I SHALL WISH TO EXHIBIT THE MACHINE. TO SUCH GENTLEMEN AS MIGHT ~~TAKE INTEREST~~ IN A THING OF THIS ~~THING~~ KIND. I DO NOT WISH TO ~~MAKE~~ A PUBLIC SHOW OF MYSELF OR MY MACHINE. I WANT ~~TO SHOW~~ IT ~~TO MEN~~ WHO CAN APPRECIATE AND UNDERSTAND MACHINERY. MR. ROCKWELL. OUR REPRESENTATIVE IN CONGRESS VOLUNTEERED TO GET ~~ME~~ A ROOM & I HAVE WRITTEN TO ~~HIM~~ ON THE SUBJECT. STILL I THOUGHT IN CONSEQUENCE OF YOUR MORE THOROUGH ACQUAINTANCE IN THE CITY THAT YOU MIGHT BE ABLE TO MAKE SOME SUGGESTIONS WHICH MIGHT BE BENEFICIAL TO ME IN EXHIBITING HE MACHINE. I WANT A ROOM LARGE ENOUGH TO RECEIVE SUCH COMPANY AS MAY WISH TO SEE THE MACHINE. I WANT A ROOM WHERE I CAN SAFELY LEAVE IT WHEN I AM ABSENT AND WHERE NO ONE WOULD BE LIABLE TO GO IN AND INJURE IT. EXCUSE THE LIBERTY I HAVE TAKEN, AND BELEVE ME

YOURS, TRULY. CHARLES THURBER.

MESSRS. ~~KELLER & GREENOUGH~~

PATENT ATTORNIES.

WASHINGTON. D. C.

WRITING FROM THURBER'S "CHIROGRAPHER," 1845.

FIG. 4

CHAPTER I.

TYPEWRITING may be clearly and accurately defined as the art of printing characters on paper, one by one, by mechanical means. If this designation be accepted, it is clear that the art stands midway between those of writing and printing, by reducing the manual exertion necessary for the one, and obviating the necessity for heavy and costly machinery on the other hand.

It is clear that very early in history efforts were made to reduce the tediousness of manual copying. Signatures were engraved on seals, and inscriptions made on wooden blocks, which, when smeared with suitable colouring matter, could be transferred to paper.

Nothing of a tangible nature was, however, evolved until the seventeenth century, when patent rights were granted for a writing engine, the effect of which was to enable several copies of one writing to be made simultaneously.

In the year 1714, Henry Mill, the engineer to the New River Water Co., obtained a patent for a machine which he stated he "had brought to perfection at great paines and expence," and the object of which was to impress letters on paper as in writing. No drawings or other particulars of this instrument are, however, available, and as suggested by the author of the "Cantor" Lectures on Typewriting Machines, it is possible that the nature of his duties as engineer to the company would hardly leave the inventor much time to indulge in the elaboration of his ideas.

There are evidences that the subject of mechanical writing occupied the minds of many people in France, and certain fragmentary records remain which clearly indicate efforts having been put forth in this direction. An embossing machine was invented in France in 1784, and, in the United States in 1829, a Mr. Burt took out the first American patent of which there is any record,

for what he called a "typographer." Unfortunately, there occurred a great fire at Washington in 1836, and all records and descriptions of this machine were then destroyed.

M. X. Progin was the next to move. This gentleman, a native of Marseilles, took out letters patent for a "typographic machine or pen." The most successful machines of to-day employ practically the same principles as were embodied in Progin's instrument. It was the first to use typebars, and the illustration shows clearly the manner in which they worked. There is the base board, upon which the paper rests flat. On a suitable frame work, supported by posts, will be seen the typebar circle, and a series of hooked wires were connected to the typebars, the sole difference being, that instead of having buttons, the ends of the connecting wires were hooked. It will be seen by the front rack, that the machine travelled over the framework from right to left, as the line was gradually filled, and downward, from top to bottom, as each line was typed. This movement of the typebar and the carriage-way and linespace racks are embodied, as we shall see hereafter, in one of the most elaborate instruments on the market at the present day.

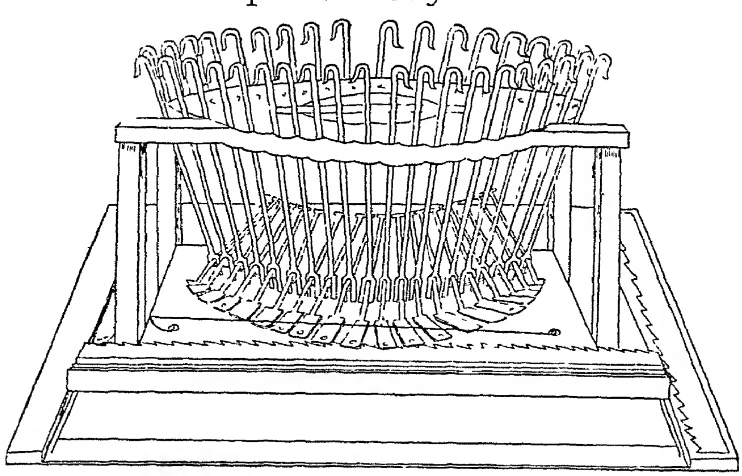
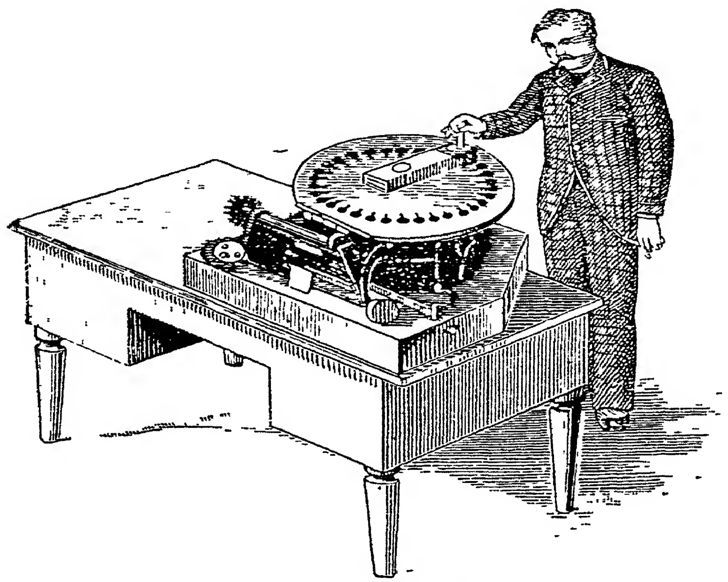


Fig 5

Progin's efforts appear to have stimulated invention in France, and a number of other inventions were protected. These do not, however, appear to have advanced the art very much, but an attempt to perfect a machine was made in 1836, of which an illustration is herewith, which bears the impress of considerable originality. It will be seen that it nearly fills an entire table. The types were arranged round a circular top plate, the selected letter being brought

into position by the movement of a pointer, which was then pressed home through an opening in the plate. We shall see, in the chapter devoted to index machines, how



A TYPEWRITER OF 1836

FIG 6

this idea has been worked out, even within the last few years, in a number of one hand or index machines.

We have now to again cross the Atlantic. During the years 1843 to 1845, Charles Thurber directed his genius to the subject, and the result was the production of a machine which was capable of actual work. On page 16 is a reproduction of a letter written by Thurber to his patent agents. Of the machine itself, the Remington Typewriter Co. have a model which was prepared from the original instructions. The view of this machine will convey a fair impression of the manner in which it was operated. A circular gallery or wheel, mounted on an upright post and capable of being revolved at will, carried round its periphery a series of three groups of keys or pistons, at the upper end of each of which was a mother-o'-pearl button or key top. The lower end had engraved on it the character corresponding with that shown on the button In order to write, the wheel was revolved to the required position, where it was held in check by a guide placed at the printing point. The button was then depressed, and the type struck against a pad impregnated with the proper ink, and then passed on to the paper, where it left its impression.

This machine, capable as it was of work, fairly good in quality, but, of course, very slow in accordance with our present ideas, marked a distinct feature in the gradual

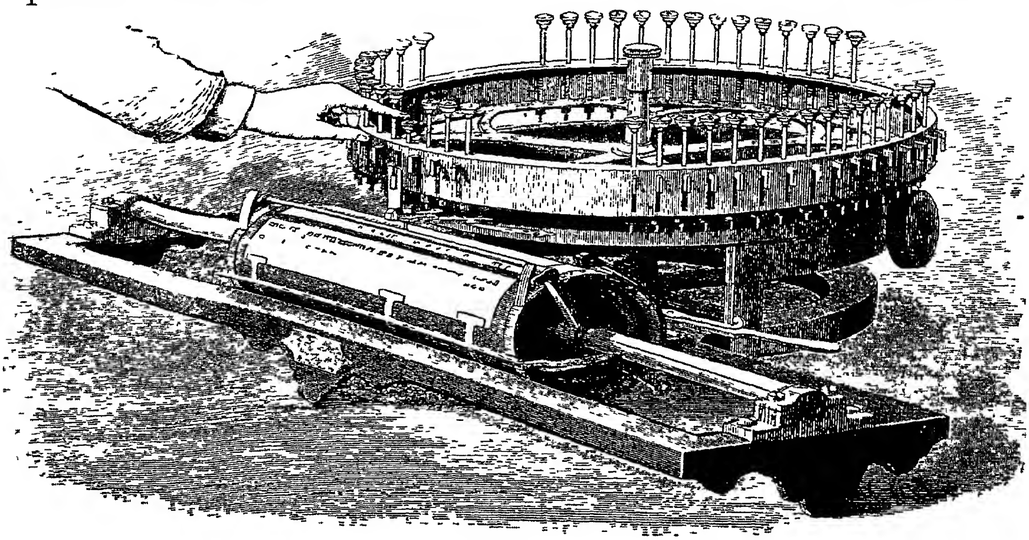


FIG 7

development of the writing machine, since it embodied the revolving and laterally-sliding carriage. Progin had the typebar, Thurber the carriage: we are progressing!

Back again in England, we find that in 1844, the Rev. W. Taylor, F.R.S., exhibited at the British Association at York a typewriting machine, invented by Mr. Littledale, a resident in that city. The principal object of this machine was to emboss the required letters for the use of the blind, but there is evidence that a slip of carboned paper was also interposed between the type and the paper, and an impression made in colour for the use of the sighted. No drawings are known to exist of this machine, but it seems that a set of types were arranged in a single row, and means were provided whereby any one might be brought under a hammer, which produced the impression. It is known, also, that wooden types were used, in order to withstand the shock produced by the continually striking hammer, but metal types were also contemplated to be used.

In 1845, Mr. Prentice, editor of the *Louisville Journal*, wrote to a friend informing him of the invention of a Dr. Leavitt, of Kentucky. He said, "A friend of mine, a very ingenious man, has just invented a typewriter. I thought you would like to see a specimen of the first work

it has done." Here, then, is evidence that the machine had been invented, and was capable of doing work. But nothing else remains of this early effort.

It will be seen that the old and the new worlds were running a race one with the other, in their efforts to bring this great invention to a point of perfection which would permit it to be made a commercial success. Up to the present, although portability and compactness had probably been the last things sought for, yet the machines were small, tiny, in fact, in comparison with the next one. This was literally a writing machine, since on the depression of the requisite levers, mechanism was set in motion which actuated a pencil, and produced a written letter. A

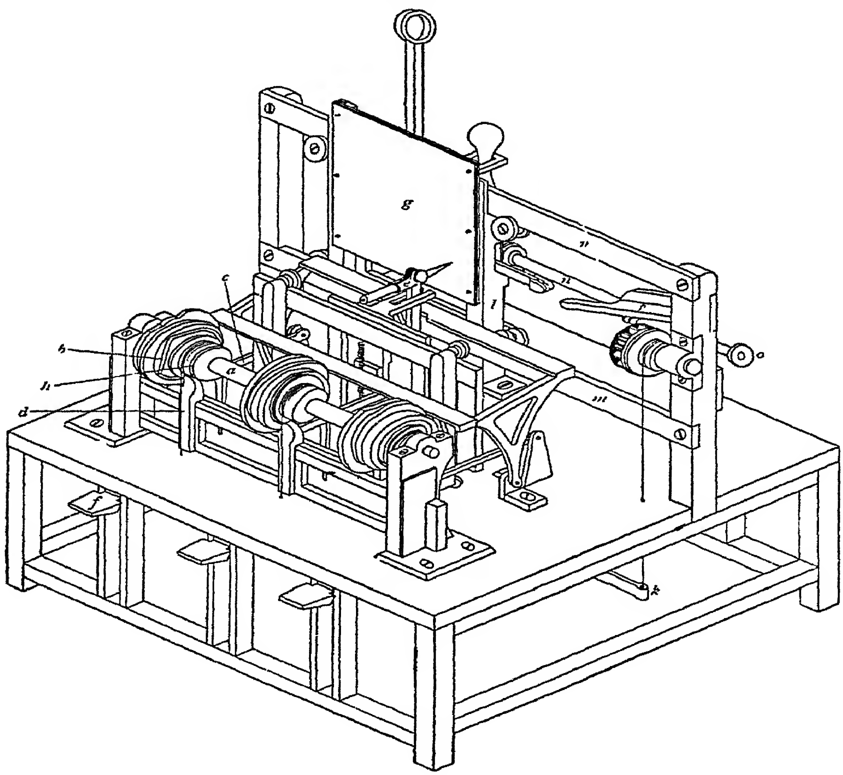


FIG 8

facetious writer might make many jokes at the expense of this instrument, but it is worthy of note that it possessed the singular property of apportioning the spaces occupied by the several characters, much greater space being allotted to "m" or "w" than would be required for "i" or "l," and so on. This, then, is the first of the "differential spacing" machines, to which reference will be made hereafter.

We must now go back again to America. During the years 1847 to 1856, Alfred E. Beach, the editor of the *Scientific American*, invented a number of machines, and a sectional view of one of them is shown in the drawing. The most noticeable feature which will strike the typist of to-day, is the key-stem passing through the bridge, the bell-crank lever pulling the connecting wire, and the pivotting of the type-levers. With this illustration before him, the operator might very well wonder wherein the inventions of the past thirty years have advanced the essential theory of the typewriter. But Beach's machine was not intended as a writer, pure and simple. It was used to emboss a narrow paper tape. This tape fed through

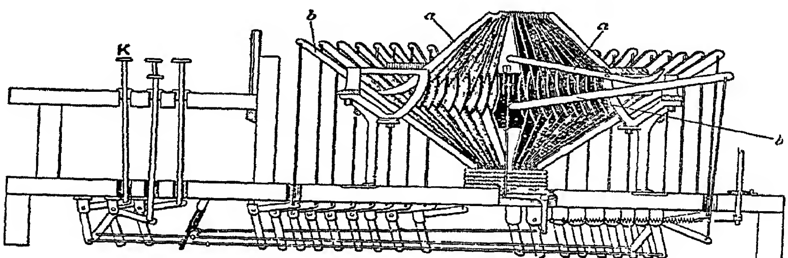


Fig 9

the centre of the machine, and the type-bars themselves worked in pairs like a pair of tongs. When a key was depressed, the lower bar rose, and the upper bar descended, and gripped the paper between them. On one bar the letter was in relief, and in the other it was sunk, so that the paper was forced into the sunken letter by the pressure of the one in relief. The typebars all converged to a common centre, and the paper was fed forward by an independent clockwork mechanism, the escapement of which was controlled by a cord, which, passing beneath the type-bars, received a pull whenever any of them was depressed, and allowed the train of clockwork to advance the paper the space required to emboss the next letter. Thus we have a third stage in the evolution of the machine, namely, the equivalent of what we now call the universal bar.

Fairbank's machine, invented in 1848, was another step in the development of the general idea. This gentleman was not a typewriter inventor, however. He was a calico printer, and with the idea of printing designs in various colours upon the fabric mentioned, he elaborated a machine in which the patterns desired were affixed at the ends of rods, all of which worked up to the same point.

In the following year, 1849, Pierre Foucauld, a blind pupil of the *Institut des Aveugles*, of Paris, invented a machine for the use of those who shared his terrible affliction. He exhibited it in Paris, and was awarded a gold medal. In the next year, the Board of Encouragement, Paris (would that we had such a Board in this country!) also conferred a medal upon him. A year passed, and he brought the machine to the Great Exhibition of 1851, to again obtain recognition and reward. A number of Foucauld's machines were made, at a price of £20 each. Being somewhat bulky, they were placed upon a low stool, in front of which stood the operator. Cassell's *Illustrated Exhibitor* has preserved to us a picture of the machine, which is herewith reproduced. K is a keyboard with two

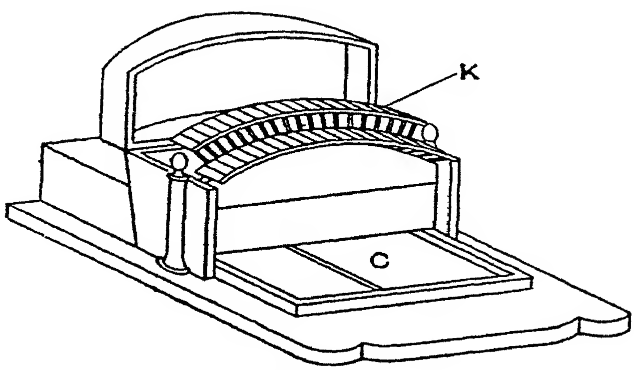


FIG 10

rows of keys. Each key was attached to one end of a slide that was fitted into one of a number of radial grooves in the machine. The free end of the slide carried a matrix agreeing with the key, and at the surface of the sheet of paper, C, the radial grooves all met, and coincided, so that pressure upon any one of the keys produced an embossed letter on the paper at that point. Of course the paper was advanced a step after each letter, and means were provided for shifting the paper for the line-space.

Keeping to our chronological order, we find that in 1850, Mr. Eddy, of Baltimore, obtained a patent for what he called a printing machine, but which was, in reality, a typewriter.

The machine was provided with seventy-eight types, arranged in the type-form in six rows of thirteen each. The form consisted of two horizontal steel plates, one above the other, one and three-fourths inches apart, and connected by columns at the angles. The top plate, *a*, is shown,

through which work the seventy-eight type-bars, the pressure being given to the types downward by the plunger, *C*, working through the standard, *S*, which is bolted to the frame. The upper part of the standard is an oblong rectangular frame so constructed as to support the horizontal shaft, *U*, and having across the top of it the projecting arm, *R*, which sustains the standards, *O′ O″*, which are the boxes of the shaft, *H*, which shaft is the fulcrum of the lever, *G*, the long end of which is connected with the plunger *C*, by the connecting rod, *I*, and the short end of which lever, *G*, is connected with the lifting rod by the connecting

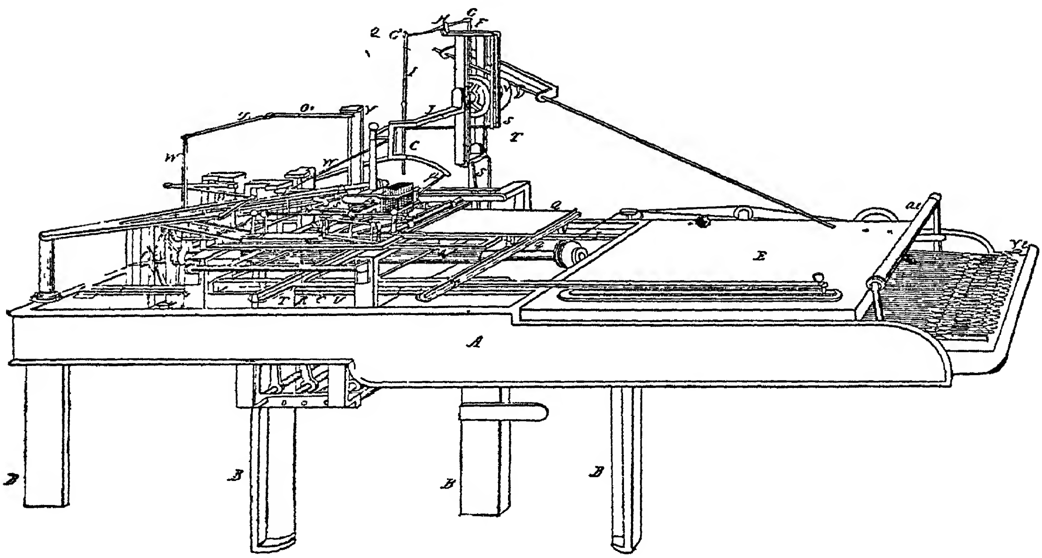


Fig II

rod, *F*. The paper table is the platform, *Q*, a plate of iron covered with cloth and supported on four feet, one of which is seen at *q*, grooved to allow them to slide on the guide-bars, *T T*, which in their turn slide on the guide-bars, *I I*, the platform being thus made susceptible of both lateral and longitudinal motion. To move the paper in the direction of the lines of printing, a rack is fastened to the under side, the end of which is represented at *g′* and which is worked by the pinion, *U*. It will be seen that in the Eddy invention the types remained stationary (excepting as each type descended to give a blow), the paper-sheet moving as each type was struck, to present a fresh place for the next one ; when the end of a line was reached, a tiny bell gave warning of the fact, and the paper-carriage

moved across automatically for the next line The type-form, however, was also necessarily given a like lateral, as well as a longitudinal motion, as all types are printed alike through a common centre, or common printing point, (through which they were also inked before striking), it being, therefore, also necessary that the entire surface of the type-form should be capable of reaching the common printing centre. This was accomplished, from left to right forward and backward, by two wedge-shaped frames, working also both laterally and longitudinally in connection with the type-levers, illustrated by the well-known process of ruling parallel lines with a triangle and straight edge ; the extent of motion either way was regulated by two series of teeth, or notches, the form moving only one notch at a time.

In the illustration, the keyboard is seen at *Yi*, with type-levers running under plate, *E*, connecting with the type-form. These levers were each provided with small hooks (under plate *E*), and when a key was depressed the brake, *ai*, was drawn back, operating the rod, *I*, which was thus drawn forward. *A* is the framework of the machine, with *b*, *b*, *b*, *b*, the standards. To make the impression of a letter, the proper type had to be immediately over the hole of the inker before mentioned. This was accomplished by the combined action of the arm, *k*, the connecting rod, *j*, moving the type-form laterally and longitudinally, and of the two gauges regulating the extent of the action of the same, involving four distinct movements in various degrees and in combinations equal in number to the number of types. Next, the paper had to be in a proper position to receive the impress ; this was accomplished by one movement of the arm, *W*, acting on the ratchet-wheel, *V*, varying in degree according to the width of the type.

At the same time that Foucauld's machine was drawing attention, two other instruments were being exhibited. One of these, by Marchesi, has entirely disappeared, but another, by Hughes, was remarkably effective, and at the same time notable for its simplicity. It consisted of a table, carrying two short upright posts, across which what we may very well call the carriage-way-rod was placed. A circular disc, carried on suitable lugs, travelled across this way-rod. The disc carried on its underneath side the various letters which the machine was made to emboss, and might be revolved to right or left in order to bring the selected letter over the point of impression. A key, which fitted into a series of holes on the disc, was then

pressed down, and locked the disc against further movement, whilst extended pressure thereon effected the printing.

On the first of June, 1852, John Jones, of Clyde, N. Y., had issued to him a patent for a machine which seemed in many respects to anticipate the course of later inventions.

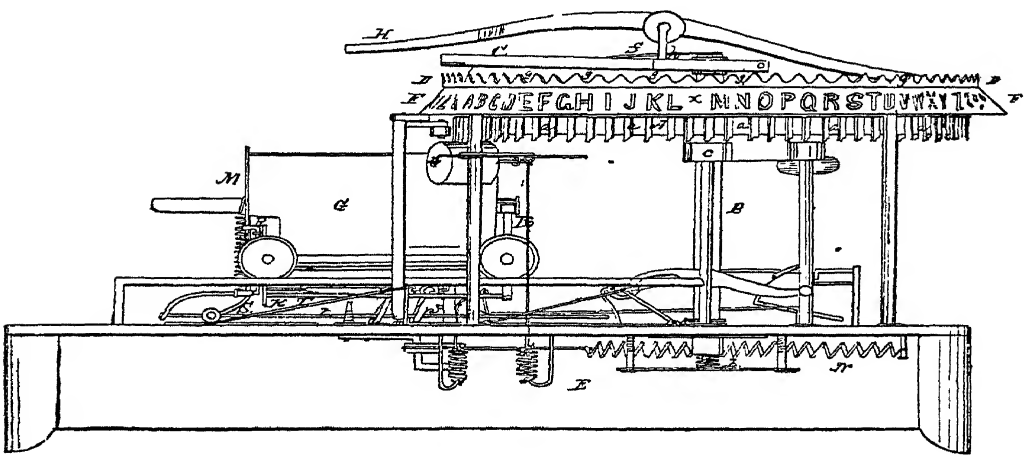


Fig. 12

The illustration of this machine, which was called a Mechanical Typographer, shows very clearly the form which it assumed, and the details are set out with unusual perspicuity in the specification. The inventor says :—

" The nature of my invention consists in placing upon the periphery of a wheel, the several kinds of type used in ordinary printing, said type having the different forms of letters, with numeral signs, marks of punctuation, etc. These types are placed vertically upon the periphery of a wheel which is horizontal and has two motions, one motion in the direction of its axis, which is vertical, and also a rotating motion. The paper upon which the types are pressed and leave their impression is placed or fastened upon a cylinder in any proper manner. This cylinder is mounted on a carriage underneath the horizontal wheel above mentioned, the carriage running upon ways, and so arranged that the upper surface of the cylinder is a short distance below the face of the type when the horizontal wheel is not depressed. The cylinder also has two motions, one motion in the direction of its axis, and a rotating motion. The horizontal wheel is made to rotate, and is also depressed by means of a lever. Surrounding the horizontal wheel there is a circular rack, having a rim on its lower

edge projecting outward. On this rim are marked or stamped the letters and all characters which are on the type attached to the horizontal wheel, a letter or character being opposite each groove or niches in the rack. An index is attached to the horizontal wheel, and so adjusted that when the end of the index is placed over a groove or niche in the rack, and the horizontal wheel depressed by means of the lever above mentioned, a type will be pressed upon the surface of the paper upon the cylinder, said type printing a letter corresponding to that marked on the rim opposite to the niche in which the index is pressed. By thus turning the horizontal wheel and depressing it, any desired letter may be printed on the paper. Every time the horizontal wheel is depressed the cylinder is moved forward before the type reaches the cylinder, and thus, a sufficient space is left between the letters. There is also a roller placed in the end of a lever and operating in such a manner that types of different sizes will be correctly spaced. The printing on the paper is formed lengthwise of the cylinder, and hence the motion of the cylinder in the direction of its axis and the rotating motion of the cylinder are for the purpose of changing or shifting the cylinder, so that the required space is left between the different lines, the cylinder being rotated the requisite distance, as it passes back after having been forced out the requisite distance and a line printed.

The circular rack or guide for the index, with the letters attached, the horizontal wheel with the type placed on its periphery, in combination with the roller and levers or other equivalent device for spacing different-sized letters properly, and the cylinder having a motion in the direction of its axis, and also a rotating motion given it by the devices shown, or their equivalents, constitute the invention.

1854 saw a machine patented by Mr. Thomas, in America. One could make such a machine with very few more materials than a knife-tray, and a couple of rolling pins. The illustration shows the machine. T in the upper figure is a typewheel, the three rows of open dots being the types. P denotes an aligning pin, by the aid of which the rolling pin is kept in position. AA in the lower illustration is a box, having open ends, and in the side of which grooves are cut, in order to carry the sliding frame F. There is a platen, or cylinder, C, to carry the paper, and the rowlock shaped opening, B, is what we might call the typebar lock of to-day. The paper is wound around the cylinder, C, which is revolved by means of the handle, H,

after each impression, and the slide, F, is pushed in the desired distance after each line. The ink can be obtained from pads on the springs, MM. This is a pleasant little machine to construct, to amuse the children on a winter's evening, but although not a practical thing in itself, it served to suggest a locking device for a much more elaborate instrument which we shall find explained in full in the section dealing with wheel machines. But if Thomas's invention seemed to anticipate the Crandall, what part did the instrument devised by Cooper, in 1856,

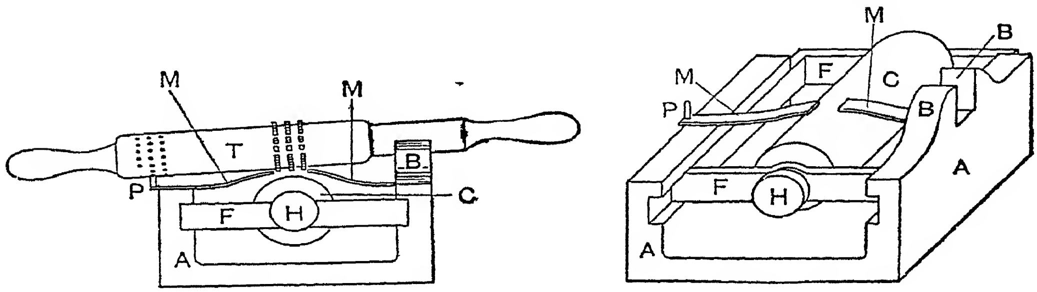


Fig 13

play in regard to the invention of the Hammond? In Cooper's machine, there was a typewheel, working on a vertical axis, with radial type, brought into position opposite a vertical sheet of paper, and then, when in this position the wheel was locked, and a hammer caused the paper to strike on to the type from behind. From the "Cantor" lectures, we gather that this instrument had a dial plate on the same axis as the typewheel, by the aid of which a letter was selected, and the same handle that was employed for this purpose was employed to lock the wheel and to cause the hammer to deliver its blow.

But whilst these minor instruments were being developed, one of the greatest scientists of the day was directing his mind to a solution of the various problems which arose. Sir Charles Wheatstone had, many years before, invented and patented his dial telegraph. "He seems," says Mr. Jenkins in his lecture before the Society of Arts, "to have soon recognised the convenience that a machine-written message for delivery would be, and there is evidence to show that prior to 1850, he had constructed a working typewriter, in which a small square metal plate or comb carrying the letter, was employed in conjunction with a hammer, by means of which a selected letter could be impressed on to a strip of paper. Although not publicly exhibited, he had one complete machine at the time of

the 1851 exhibition, and he then let the matter rest for a while. Afterwards he took the matter up again, and between the years 1855 to 1860, he had (with Mr. Pickler, of Buda Pesth) completed no less than six different machines, of which three remained in a complete form. Although they would not by any means meet the requirements of the present day, yet they were marvels of ingenuity, and are still in more or less working order. . . . . They are now in the South Kensington collection."

We now illustrate and describe, as briefly but as clearly as possible, these early machines.

WHEATSTONE'S FIRST MACHINE.

In this machine there was a keyboard somewhat resembling the manual of a piano. There were thirty keys in all, twenty-nine of which were employed for the imprinting of letters, etc. and the other was a space key. The type were mounted on flexible tongues of metal resembling

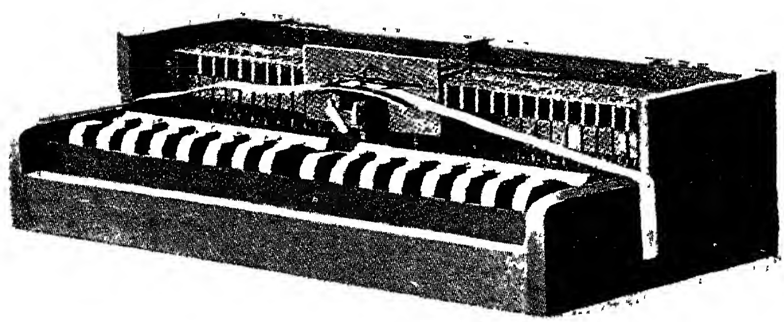


Fig 14

the teeth of a comb, which is at the top of the machine and is segmental in shape. Each key forms one arm of a bell-crank lever, and when depressed forces the other arm into a horizontal slotted plate, connected with the comb, and so arranged as to slide the latter sideways until the particular type is brought under a hammer, which then delivers the blow. After each impression the comb is brought back into its position of rest by means of two springs. As the key rises, means are provided to ensure the paper travelling the required distance.

We present two illustrations of this machine, the one showing the completed instrument, and the other being an outline only, very much simplified and with portions omitted, but which will show the operative portions much more clearly than the other and more finished illustration.

In the outline, the steel comb carrying the various types will be seen, and this, of course, is moved from side to side by the operation of the keys in order to bring the required letter over the printing point. Above it, like an inverted J, will be seen the hammer, ready to pounce down upon the tooth of the comb, directly it is in the proper position to receive the blow.

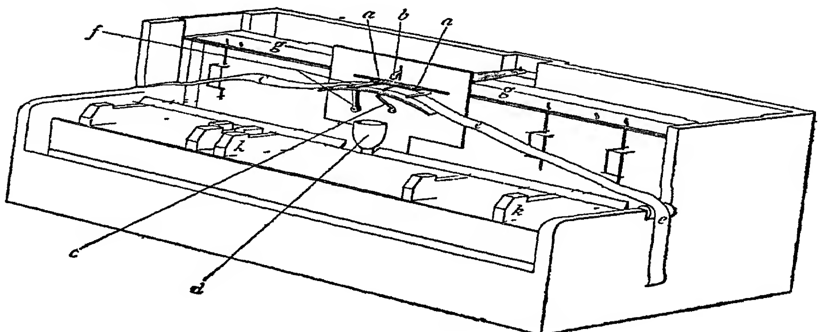


FIG. 15

WHEATSTONE'S SECOND MACHINE.

The second machine, which was made in 1856, affords a distinct improvement on its predecessor, since it permitted small and capital letters to be written. The following

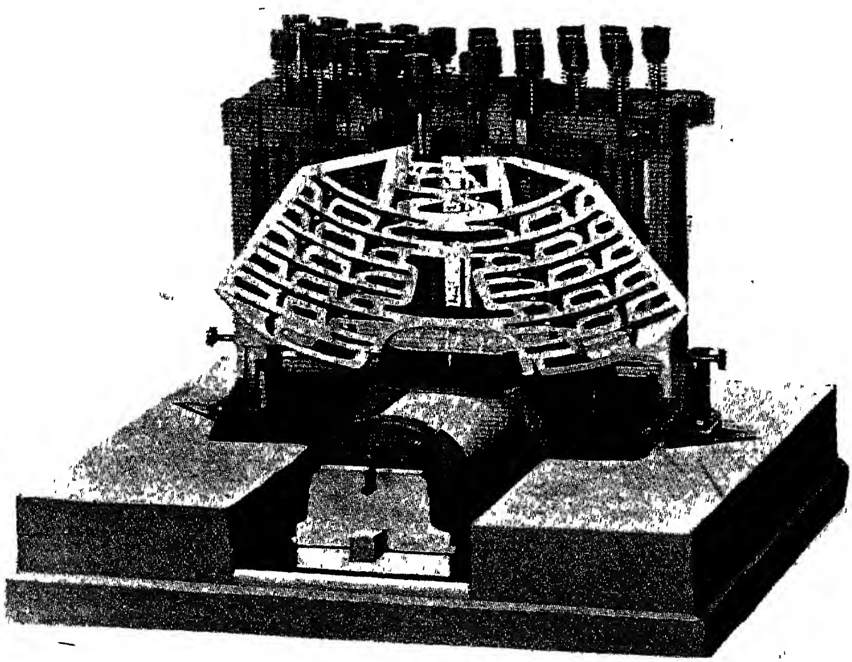


FIG. 16

description, drawn from the catalogue of the exhibits in the South Kensington Museum, will be found of interest by mechanically minded readers, those, however, who are not " built that way " will probably be content to examine the illustrations, of which we present two, representing the front and back views of the machine.

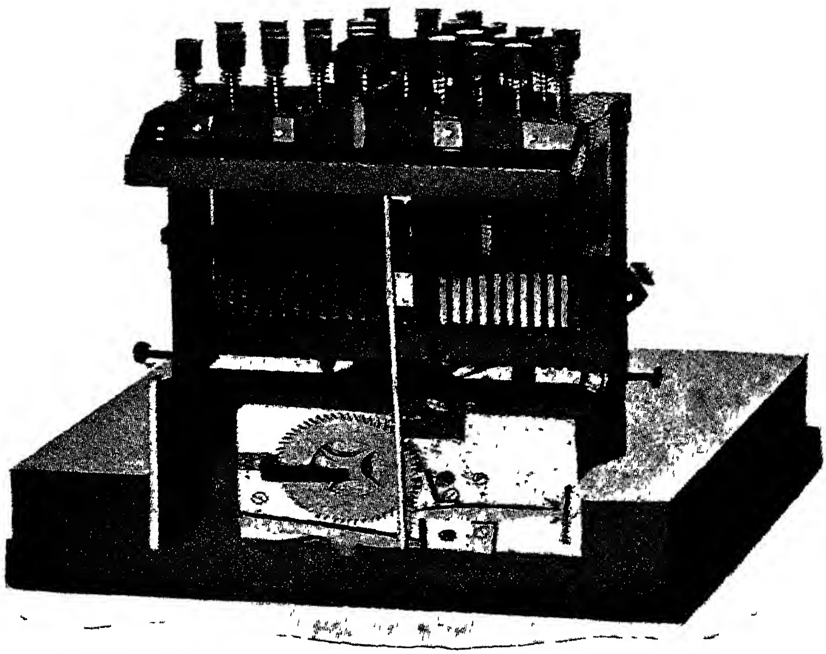


Fig. 17

" The comb is still retained, but forms part of the surface of a cylinder whose axis is the centre of a swinging segmental plate containing cams, by means of which it can be swung into various positions. On an elevated keyboard are twenty-six round keys forced upwards by springs (see account of the " National " typewriter later); each key carries a small pin on its side that engages with a separate cam groove in the segmental plate. By causing the keys for the symbols further from the printing point to act in the centre of the plate, it was possible to make the grooves nearly alike. Change of case was accomplished by mounting on the segmental plate a second comb that is brought beneath the printing hammer, by sliding it along the arbor, by a key provided for this purpose." Inking is effected by a small revolving wheel.

WHEATSTONE'S FINAL MACHINE.

In the final attempt of Sir Charles, we find him reverting to his original outline. The instrument is more compact, but is still able to express both capital and lower case letters. The cylindrical paper carrier is clearly defined, but it is said that the touch is heavy, and the inking arrangements are no better than are several machines of later date.

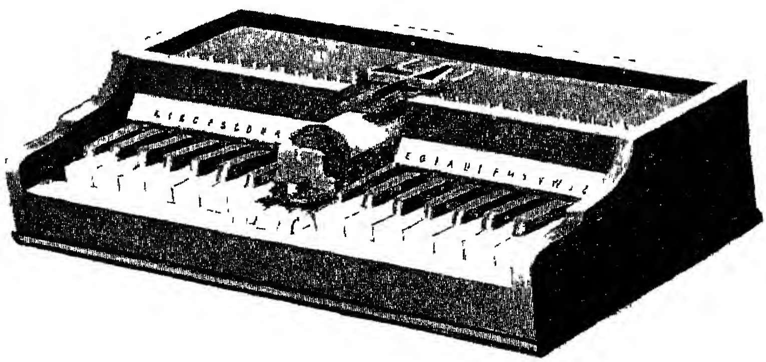


FIG. 18

The piano keyboard arrangement possessed a fatal fascination for many inventors, and there is no doubt that, by the adhesion to this defect, the production of the perfect machine was ultimately delayed. Dr. Wm. Francis, of New York, essayed, in 1857, another machine, having a somewhat similar outline to Wheatstone's, but it is clear that the area of finger movement is too great, and the force required to depress the keys far too heavy.

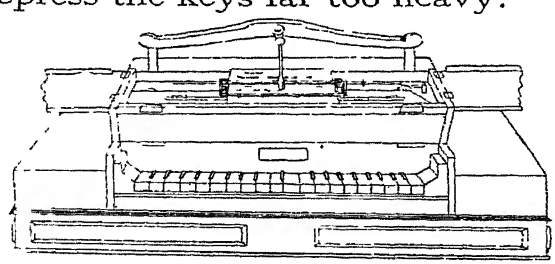
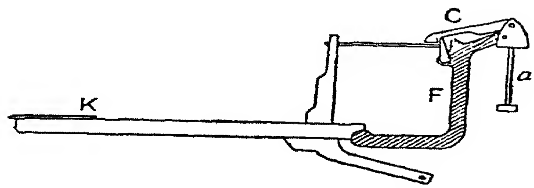


FIG 19

We present three diagrams of Francis's machine, the one showing in outline the general appearance of the instrument, and the other two denoting the typebar movement, with the bar at rest and in contact respectively. This typebar movement is exceedingly interesting. In the diagram, K represents the lever, the shaded portion, F, denoting the framework of the machine. The typebar, A, falls perpendicularly when at rest, but on the depression

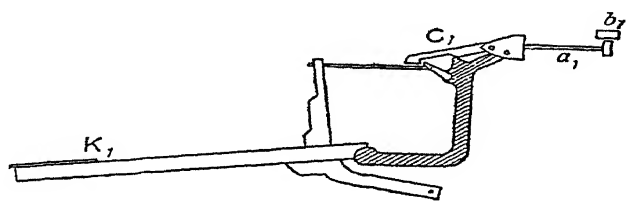
of a key, there is a tripping mechanism brought into motion, which forces the type upwards. There is no direct connection between the lever, K, and the typebar. In this Francis seems to have anticipated two or three machines, the English, Franklin, and Daugherty, as all these make a special point of having no connecting wires. Francis

FIG 20



must also be credited with obtaining his ink supply from a silken ribbon saturated with colouring matter, his carriage was pulled along by means of a spring, and kept in check

FIG 21

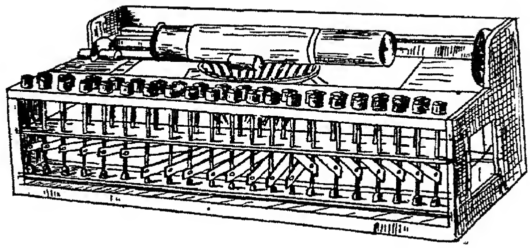


by the action of an escapement, and he appears to have had a centre guide for his types to strike through. Had it not been for his piano-keyboard, it is more than possible that he would have obtained a very considerable amount of success.

In 1861, Thomas Hall, of New York, who later on achieved fame and, undoubtedly, profit, by means of a small portable machine to which he gave his name, laboured upon a larger machine, and in due course produced and took out letters patent for a keyed typewriter. From a rough illustration which was given in the *Phonographic World*, of New York, it would appear that this machine was about 18 inches square by say six inches high The grant is dated 1867. In this grant, provision is made for a rocking shaft for moving the carriage, the inking is effected by means of a ribbon saturated with ink, and various other points, long since made popular, were anticipated. Two instruments were built in 1865, one of which was provided with a complete fount of upper and lower case letters. It was exhibited at the Paris Exhibition in 1867. The other was put into constant use, and is said to have been equal to a speed of 400 letters per minute.

Whilst Hall was working on his machine, Mr. George House, of Buffalo, New York, produced, in 1865, a machine on quite novel lines. From the illustration it will be seen that the types were arranged in a basket, striking up to a

FIG 22



common centre, and the paper was wound round a cylinder, supported by a carriage. After the depression of a key the carriage did not move along laterally, as now, but revolved, as we have seen was the case in Thomas's machine There were forty-one keys, and the general idea seems to have been exceptionally good.

The next step in the evolution of the writing machine was made by John Pratt, an American, at that time residing in London. In 1866 he took out a patent for a machine, afterwards exhibited before the members of the Society of Arts, in which he employed a small plate of metal bearing the fount of letters arranged in rows upon it. This was supported vertically, and placed behind a sheet of paper held in a similar position. He provided means whereby the plate could be moved in any desired position, so as to bring the selected letter behind a small hammer. The depression of a key caused the plate to move to the required position, the hammer to strike the blow and the paper to shift along to make room for the next letter. This machine has passed into oblivion, but many years after, a later and very highly improved model was discovered, and after renovation and repair found its way into the national collection at South Kensington. The later instrument, of which two illustrations, representing the front and back views respectively, are presented, contains several very important features. In place of the type plate it carries a small typewheel, on which the letters are mounted in three horizontal and twelve vertical rows. This wheel is connected to a train of clockwork that tends to rotate it, but is prevented from so doing by means of a tooth mounted in a notched circular plate, placed at the foot of the vertical shaft of the typewheel. The shaft can thus be brought to rest at positions corresponding each to a single vertical row

PRATT'S MACHINE.

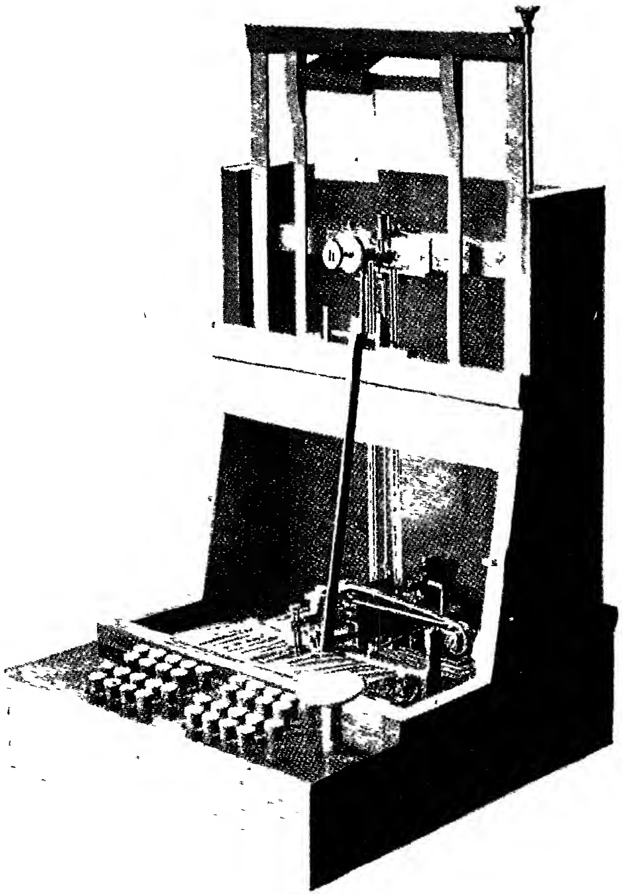


Fig. 23

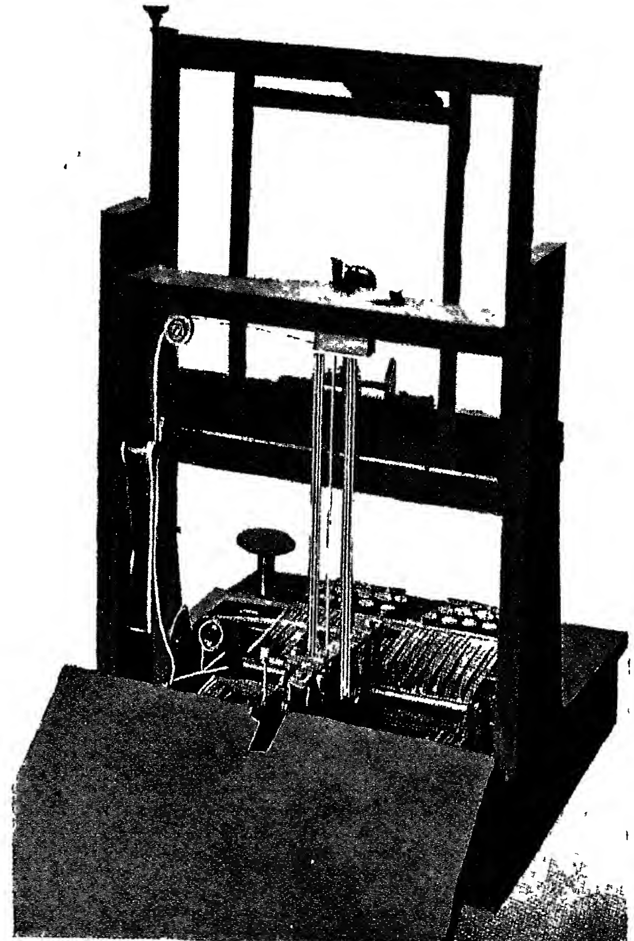


Fig 24

of letters by means of stops acting in the notched plate, and operated by the respective keys to which the letters belong. A second motion could also be given to the wheel in the direction of its axis, and thus the letter of any one of the three horizontal rows selected. Both these motions were controlled by one movement of the key, and the same movement, when continued, caused the hammer (marked by the letter *h* in the front view) to be struck. The return movement allowed a coiled spring to draw the paper carriage a step onward. The big key on the right of the keyboard served to return the paper carrier (or carriage) back, and automatically shifted the same up for a fresh line.

Those who desire to know more precisely how this early effort operated, may carefully consider the following additional details, extracted from an article written by Mr. Arthur E. Morton in the *Phonographic World* Mr. Morton says :—

"The working parts are of brass, steel and iron, the frame being made of the best black Spanish mahogany. The latter contains the working mechanism and is composed of two rectangular frames, mounted the one on the other, giving the side elevation an "L" shape. A number of levers, furnished at each end with keys, extend from the front to the back of the interior of the case. Extending across and a short distance above these key-levers, near the centre of the case, are two oscillating bars, *A*. Between the fulcra of the key-levers and the oscillating bars just mentioned are two other oscillating bars, also placed above and across the key-levers, and fixed below the flat key-lever springs, *B*. Three of these oscillating bars are moved simultaneously by each key and perform simultaneously the three different operations requisite in a machine for writing with type, viz , bringing the types in arbitrary succession to one point, forming a corresponding impression there, and moving the paper.

"First, as to the manner in which the types are brought to the same point. They are arranged in three rows on the face of a small wheel of half an inch diameter, *C*. This wheel is attached to a vertical steel wire, *D*, which, at its lower extremity, has attached a small spur wheel, *E*, controlled by an elongated pallet, *E* (which is caused to oscillate by one of the oscillating wards, the pallets for governing the movement of the line-frame seen below and, at the same time, rocks the type-wheel pallet free from the spur-wheel). Attached to, and immediately below the spur-wheel, is an elongated pinion which is always in contact with the gear

PRATT'S MACHINE

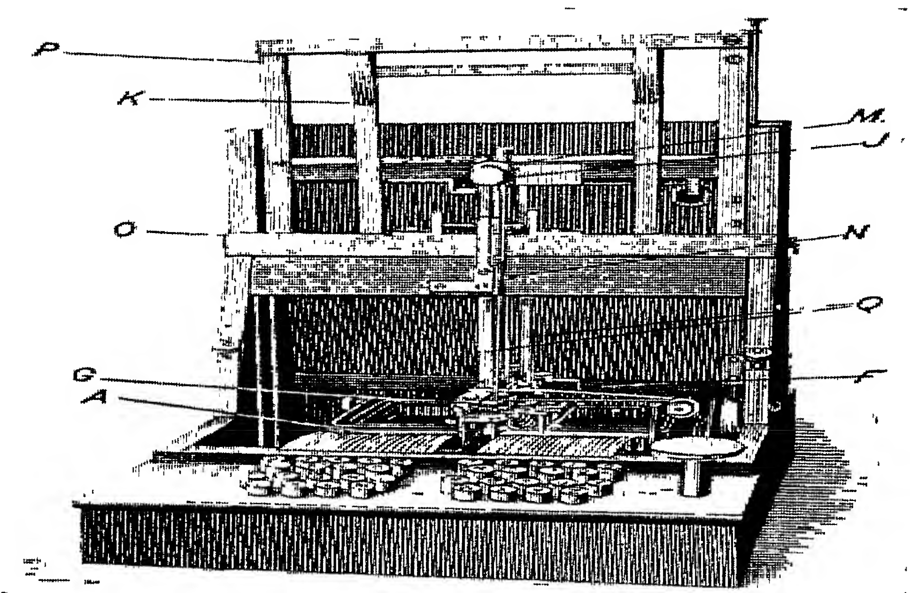


FIG 25

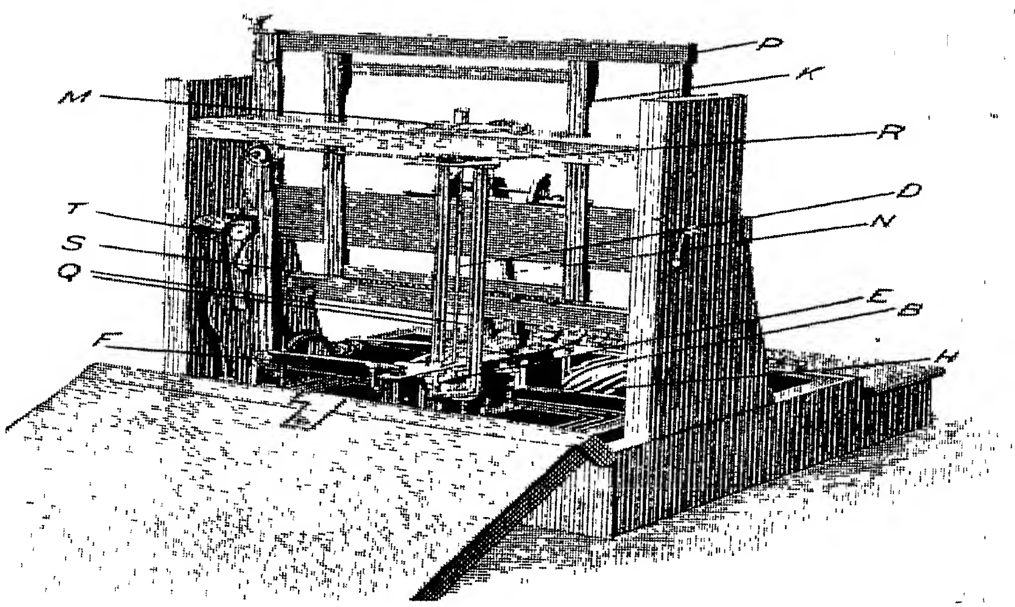


FIG 26

movement, actuated by a spiral spring, *G*, for imparting the rapid movements to the type-wheel; now, to cause the partial or complete rotation of the type-wheel a most ingenious system of universal bars, I, arranged one within the other, twelve in all, six being placed each side of the type-wheel gear. These bars rest upon the ends of the key-levers, which are notched so as to raise its universal bar, and, since there are thirty-six characters, it follows that each universal bar is responsible for three characters being brought to the printing point Resting upon each universal bar is a small hammer, *H*, whose shaft converges from a slotted ring, it is the inner extremity of the hammer shaft (which is oscillated by a depression of a key and universal bar) which governs the partial or complete revolution of the type-wheel, for instance, suppose we depress a key, the hammer is tilted and thereby rocks its inner extremity inwards, and the same operation simultaneously releases the spur-wheel pallet, and, the type-wheel being free, its spring causes it to rotate rapidly, but since there is a projection on the type-wheel shaft, it is immediately arrested by the hammer-shaft projection, and the striking hammer, *J*, lets fly against the type, leaving an impression upon the paper attached to the line-frame, *K*. Upon releasing the key, the projection resumes its normal position and the pallet having engaged with the spur-wheel, the type-wheel is necessarily stationary until the depression of a another key. Above and across each key-lever towards the front of the machine are two oscillating bars (before mentioned) across which at right angles, is a lever, *L*, which is automatically raised by the depression of the key; each oscillation of these bars raises the type-wheel the necessary distance, that is, to the second or third rows of type on the type-wheel, and to assist in a rapid return of the type-wheel, a flat spring, *M*, is constantly pressing on the top of the type-wheel shaft. The lever for raising the type-wheel may be compared with the shift-key levers embodied in the construction of the "Hammond" typewriter, and the small hammer-headed like projection to the stop or index pins which, by means of the stop arm (also identical in the Pratt and Hammond machines), which arrests the movement of the type-wheel immediately the requisite type has been brought to the proper centre.

"Second, the impression is effected by a hammer, *J*, having a face equal in extent to a single type, which face is covered with a strip of ivory, backed by a small spiral spring so as to break the force of the blow; this hammer

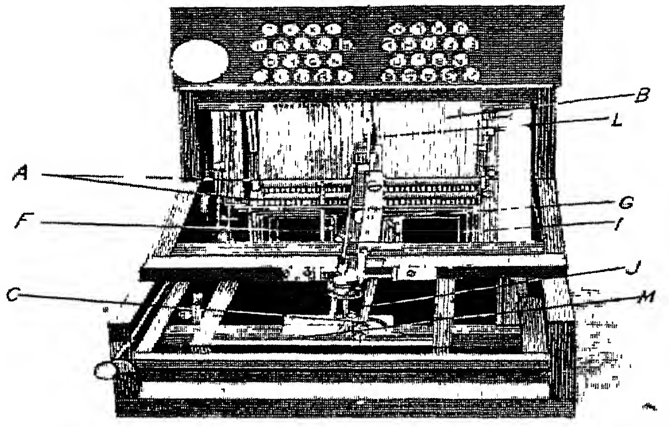


FIG 27

strikes against the face of the several types the instant they are brought within its range, a sheet of carbonized paper, held in contact with a sheet of writing paper, being suspended between the hammer and the type-wheel. Transparent transfer paper may be also employed as well to enable the operator to see the progress of the writing as to preserve a copy. The hammer is operated by an oscillating bar, *A*, with which it is connected by a small rod, *N*, hinged to its butt This rod has on its lower end a catch, which engages an arm projecting from the oscillating bar, *A*, and, having an eccentric movement, it causes it to act in a manner somewhat analogous to the hopper of a piano. The depression of a key lowers this eccentric arm, and retracts the rod of the hammer. Just as the key has been carried through to its full movement, and the corresponding type brought to a proper position, the catch is pushed off the eccentric and the hammer is impelled against the type by a spring, *O*. When the key is released the arm of the oscillating bar engages the catch, and the hammer is ready for a new stroke. It is, however, necessary by this arrangement to release one key before striking another; and it is this necessity that limits the rapidity of the instrument, which otherwise might have struck off printed characters as fast as the piano can yield consecutive notes.

"Third, now for the feed of the paper. A square open frame, *P*, which for distinction may be termed the page-frame, slides in vertical grooves formed in the upright part of the case, in the plane of the type-wheel. Within this,

a second frame, *K*, which may be termed the line-wheel, moves horizontally from right to left. The movement of the latter makes the lines, and of the former, the pages of writing. The movement of the line-frame is given by two steel spur rods, *Q*, revolving in vertical bearings, the left one being impelled by a spring, *R*, which is wound up at the completion of each line by depressing the large ivory knob seen on the right side of the keyboard The motion of the rods is communicated to the line-frame by a small brass rack, *S* Both rods turn with line-frame during the progress of the writing. Their regular movement is controlled by an escapement wheel and pallets attached to the right spur-rod, the latter being connected by a link, *F*, with an arm projecting vertically from the oscillating bar, *A*, which operates the striking hammer. The same key stroke which moves the hammer produces an oscillation of the pallets, and allows the paper to move the distance of a letter and space. The oscillation of the pallets may be effected by a partial movement of the keys, so that the paper can be moved without moving the striking hammer, when it is required to make a space instead of a letter.

"By this means the inventor got rid of the space bar or key used in all previous and subsequent machines of this class, every key serving as a space key. The carbonized paper and writing paper are held in a clamp, resting loosely in an angular projection of the line-frame, whence they are easily and quickly removed for a fresh sheet of paper. It only remains to show how the paper is brought back to its starting point for a new line. To make the proper interval between the lines, the page-frame is provided with a rack, *T*, moved by a pawl of peculiar form and construction, it leaving the teeth always free, so that the frame may, at any stage of the writing, be moved in any direction. The pawl is operated by the depression of the large ivory knob seen on the right side of the keyboard, with which it is connected by a lever and vertical link rod. A page being completed, a new sheet of paper is placed in the clamp, and the page-frame is pushed back to the bottom of the grooves. The depression of the aforesaid knob restores the lost power of the line-frame and the type-wheel springs."

Pratt's machine was by far the most complete and practicable machine which had appeared up to that date, and it is owing to its appearance, and the newspaper articles and discussions which it provoked, that we owe the type-writer of to-day.

The London papers, and most of the technical Press, entered very largely into the merits of a machine which would permit writing to be executed by mechanical means. Very many sober-minded persons ridiculed the idea, whilst others, waxing enthusiastic, proclaimed the near advent of a time, when speeches should be followed verbatim by some such means. Others, again, adopted a medium course, and were content to await developments, contributing each of them his quota to the general fund of knowledge.

It was whilst these discussions were proceeding that the *Scientific American* published an article which was the direct cause of the invention of the ultimate machine. This article, after stating that not only would the inventor of a successful writing machine confer a benefit to all mankind but would also, incidentally, reap a fortune, proceeded as follows :

" A machine by which it is assumed that a man may print his thoughts twice as fast as he can write them, and with the advantage of the legibilty, compactness, and neatness of print, has lately been exhibited before the London Society of Arts, by the inventor, Mr. Pratt, of Alabama. The subject of typewriting is one of the interesting aspects of the near future. Its manifest feasibility and advantage indicate that the laborious and unsatisfactory performance of the pen must, sooner or later, become obsolete for general purposes. Legal copying, and the writing and delivering of sermons and lectures, not to speak of letters and editorials, will undergo a revolution as remarkable as that effected in books by the invention of printing, and the weary process of learning penmanship in schools will be reduced to the acquirement of the art of writing one's own signature, and playing on the literary piano above described, or rather on its improved successors." With one solitary exception—the sentence relating to penmanship—this article was prophetic in every word.

This article, published as it was in the leading scientific paper in the United States, drew to itself a considerable amount of attention, and it was shown to Charles Latham Sholes.

Long before Pratt's machine had attained notoriety, however, Mr. Sholes had been engaged in perfecting an invention for printing in the numbers of pages in bound books, and it is recorded that whilst so engaged, a friend put to him the question, " If numbers, why not letters ? " Nothing,

however, came of the suggestion, but when the paragraph quoted was brought to his attention, Sholes considered the matter, and came to the conclusion that the idea was practicable. Glidden, the name of the friend who had brought the article before Sholes, discussed the matter at length with him, and the two of them went to see a third individual, named Soulé. One can very well imagine the interest with which the three talked over the matter, how the *pros* were weighed with the *cons*., and a hundred and one questions discussed. Eventually the three joined hands, and, entering into a partnership, set out to invent the type-writer. How far they had knowledge of all that has been detailed in this chapter, or indeed whether they were familiar with anything of the previous efforts in the same direction, one can hardly say. Glidden found the money, Sholes invented the spacing mechanism, and the idea of converging typebars was suggested by Soulé, and agreed upon without any discussion. Other minor details of the first machine were also suggested by him.

It will now be interesting to quote the tale, as it gradually proceeded, from an old catalogue issued by the Remington Company, many years back. In this catalogue it is stated : —

"They began work at once, and by the next September the first machine was finished, and letters were written with it. It worked successfully so far as to write rapidly and correctly, but trial and experience showed it to be far short of an acceptable, practicable writing machine. But letters were written with it, and sent to acquaintances and friends, and among others, one was sent to Mr. James Densmore, then of Meadville, Pa. Mr. Densmore was so impressed by it that by return mail he asked to become interested in the enterprise. Mr. Sholes replied that two others were already connected with it, but that he had consulted them, and was authorised to offer an undivided one-quarter interest in it for the payment of all expenses up to date. Again by return mail Mr. Densmore wrote that he would accept the proposition, and asked that the bill of the expenses be sent him. Thus Mr. Densmore bought a quarter interest in it without ever having seen the machine or knowing the price : certainly an evidence of faith and enthusiasm. Mr. Densmore did not see the machine till March, 1868, and then he pronounced it as a machine good for nothing except to show that the idea was feasible. He pointed out defects which needed to be remedied before the machine could be

made practicable, and urged continuous efforts to devise what was suggested.

"Directly thereafter, Mr. Soulé and Mr. Glidden dropped out of the enterprise, and the typewriter was left entirely to Messrs. Sholes and Densmore. Mr Densmore promised to pay all expenses, and again urged Sholes to persevere in making improvements, which Mr. Sholes did with marked and successful results.

"Numerous conceptions were made. One device after another was conceived and developed till twenty-five or thirty experimental instruments were made, each succeeding one a little different from and a little better than the one preceding. They were put into the hands of stenographers, practical persons who were presumed to know better than anyone else what would be needed and satisfactory. Of these, James O. Clephane, of Washington, D. C., was one. He tried the instruments as no one else had tried them; he destroyed them, one after another, as fast as they could be made and sent him, till the patience of Mr. Sholes was exhausted. But Mr. Densmore insisted that this was the very salvation of the enterprise; that it showed the weak spots and defects, and that the machine must be made so that anybody could use it, or all efforts might as well be abandoned; that such a test was a blessing and not a misfortune, for which the enterprise should be thankful."

By reference to the annexed illustration it will be seen that Sholes first embodied the pianoforte keyboard in his

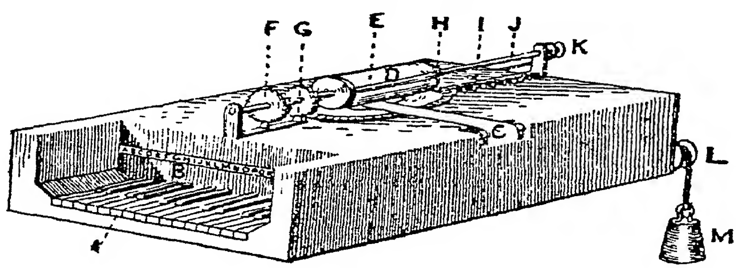


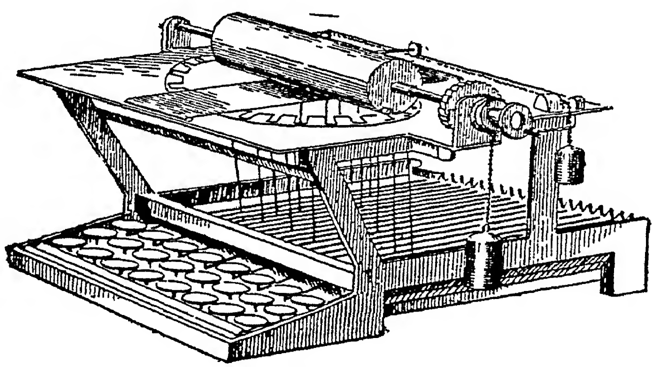
FIG 28

model; the paper, rolled round the cylinder, *D*, was fastened in position by fixing the clamp, *E*, over the edges; it was a type-bar machine, with the levers hanging vertically round a circled opening in the top of the frame, so that the type struck upwards at the common centre—each bar had but one character, a small capital, punctuation mark, or numeral. The inking was accomplished by a travelling ribbon, *C*, which, after passing horizontally over the top,

proceeded down the side, beneath the key-levers, then up the other side, and again over the top. Each key as depressed caused the cylinder, by pawls, *G*, and ratchet wheels, *F*, to partly revolve; at the end of the line the cylinder shifted along the axis rod for the line-spacing, the rack, *I*, engaging with a spring flange, *H*, on the cylinder, thereby acting as a cam. Incident with this movement the clamp, *E*, rotated quickly across the printing point, the ratchet wheels, *F*, having a slip-space for the purpose. The weighted cord passed over three pulley wheels, two of which are seen at *K* and *L* These pulley wheels imparted the requisite power for winding the ribbon and rotating the cylinder for letter spacing and line spacing.

The next diagram illustrates one of Sholes's later attempts, probably about the year 1870; it differs chiefly in the design of the framework and the adoption of the well-known keyboard.

FIG 29



It would appear to be about this time that the late Mr. G. W. N. Yost was invited to Milwaukee to inspect the then last machine made. Up to that time, some fifty machines had been made, mostly in country blacksmith style, at an average cost of about fifty pounds per machine. Mr. Yost, with the trained eye of a skilled mechanic, saw at once where the defects were. He suggested certain minor alterations and improvements, but he pointed out, and urged the absolute importance of such an instrument being made under the most skilful supervision. He indicated precisely how necessary it was that the most perfect fit should be obtained for the various parts, how skilfully each part would have to be adjusted, how finely the various working parts would have to be made. He drew attention to the fact that only the most perfectly equipped factory, having all the latest forms of machinery procurable, could

turn out a writing machine which could withstand the shock and rattle of every day use, and therefore suggested that the instrument should be taken to the Remington Armoury at Ilion, New York, where it could receive the attention and care, coupled with skill and suggestion, which it desired and deserved. His views were fallen in with, and the Remington Armoury made three model machines which "passed muster," and were regarded as satisfactory. It would not be correct to say, as some enthusiastic supporters of Mr. Yost have urged, that he made the Remington, but he certainly did make it successful.

A contract was now placed for the manufacture of one thousand Sholes and Glidden typewriters, and the form which they assumed will be gathered from the accompanying illustration. The following account, drawn from the

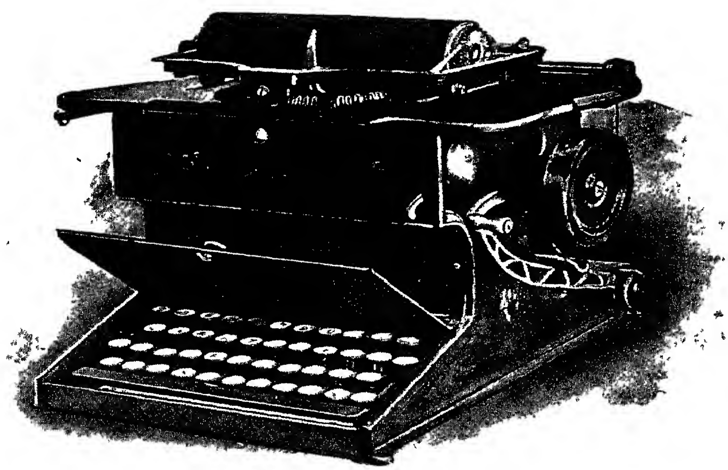


FIG 30

catalogue of the South Kensington collection, will be sufficient to form a clear conception of the machine :—

"It is a typebar machine, with the levers hanging vertically round a circular opening in the top of the frame, so that the type strike upward at a common centre. There are forty-four keys, connected by horizontal levers and vertical wires to the same number of typebars. Each bar has but one character so that there is no change of case, and only one printing point. The platen cylinder is supported in a carriage that slides on a rod at the back and is supported by a wheel in front. The paper, which may be of any length, but not more than 8.25 ins. wide, passes under the platen cylinder, with which it is held in contact by two rubber bands passing round rollers on the carriage. To inspect

the work, the carriage can be swung upwards round the guide rod, which acts also as a hinge. The carriage is continuously pulled to the left by a spring, the motion being checked by a rack attached to the carriage, and engaged with two vibrating detents that release one tooth with each character printed. At the end of the line, the carriage is returned and the cylinder slightly rotated by a cord attached to an external lever at the right hand side ; this return movement also winds up the feeding spring. Inking is done by a wide ribbon, interposed between the paper and the type. The ribbon is stretched horizontally over the top of the framing from a spool on each side, and is slowly wound alternately from one to the other by the motion of the machine The reversal of the winding, when either spool is emptied, is performed by a hand moved clutch.''

One or two special points will immediately arrest the attention of the practical operator. There is a copyholder attached to and forming part of the machine. This will be seen from the illustration, being folded back under the top plate to the left. The types were to be forced into alignment by means of **V**-shaped continuations of the typebar hangers. The coffee mill handle for returning the carriage might have been a good thing, had it been continued to the ground and operated by the foot : but one would pity the machine for the jarring it would get from the returning of the carriage.

The Sholes and Glidden typewriter had not a very prolonged career. After a time it was taken over bodily by the Remington people, who henceforward gave it their own name. Sholes, after many years, worked out a totally different machine, having visible writing. Yost also produced the Caligraph, and later on an improved instrument to which he gave his own name, and which is a now prominent favourite The Densmores have also been associated with a third instrument for many years, a full account of which will appear hereafter. The history of the Remington is indissolubly wound up with the history of the typewriter, and that of the typewriter with the Remington, up to this time. But there are other machines, and these we shall deal with in later chapters.

CHAPTER II.

BEFORE proceeding with the tale of the typewriter, and the various forms which it has taken and the improvements made from time to time therein, it may be desirable to consider two very important questions, namely, what the typewriter does, and how it is done. In order to carry out its objects, the typewriter contains two important sets of mechanism, *viz.* :—

The means by which the type is brought to the paper.

The means whereby the paper is shifted.

For the purpose of considering these points, we may assume that we have a machine—any machine having typebars will do—before us. We will go over this instrument, point by point, and indicate what its chief parts consist of, what they do, and how they differ from other machines.

The first and most noticeable feature of any machine is the keyboard. Perhaps the word "manual" would be more expressive, but as the former expression has passed into vogue, we will adhere to it in these pages, merely indicating our belief that it is not the best term that could have been devised.

The first practicable machine on the market having been the Remington, let us examine the keyboard of the instrument. According to the latest and most approved form, this is as follows :

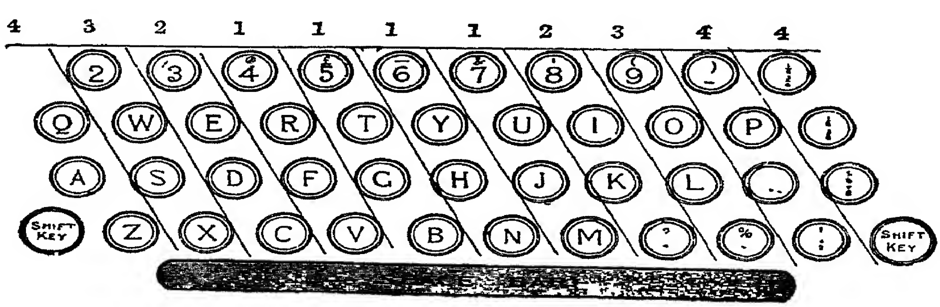


Fig. 31

When the machine is in normal position, the depression of any of these keys will cause the lower case letter corresponding thereto to print In order to obtain the capital or upper case letter, it is necessary, first of all, to depress what is called the shift-key, *viz.*, that on the lower left hand corner of the machine, and when this is done, the carriage is moved forward, and the key, being depressed, imprints the capital letter. Thus, a double movement is necessary in order to produce what, after all, is but a primary result.

In order to obviate this necessity, a number of machines have been devised, wherein the keyboard is so extended as to provide a separate key for every character carried by the instrument. The first of such machines was the Caligraph, of which a full account will appear hereafter. In this instrument, a very peculiar system was adopted. The keys slightly differed in their arrangement to those on the Remington, and the lower case letters were grouped in the centre of the manual, the upper case and figure keys surrounding them like a protecting halo. The following diagram will render this clear.

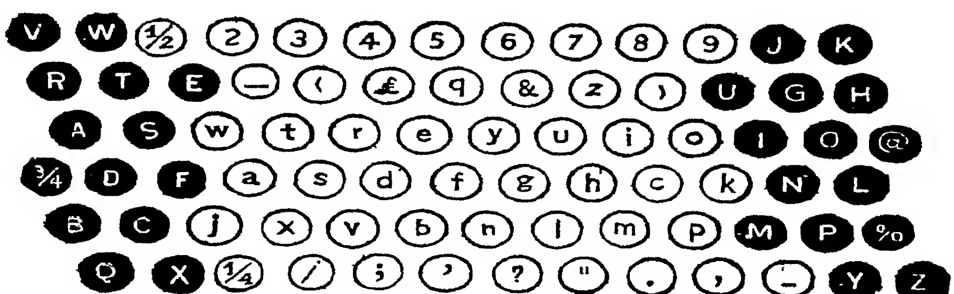


Fig 32.

This lack of uniformity of arrangement jarred on the nerves of many people, since it involved the memorising of the position of every single key, so that when the Bar-Lock was placed upon the market, a double series of keys was provided, every one of the upper case being in exactly the same position as those in the lower case arrangement. Thus, although the Caligraph was the first machine with a *complete* keyboard, the Bar-Lock was the first with a double arrangement. The simplicity thus afforded is apparent, when it is remembered that, in order to strike an upper case letter, the position of the hands is not varied, all that is required being to lift the hands bodily up to the upper banks of keys.

But with many persons, the shift key did not seem to be a source of trouble. They considered the idea good, and

that the only weakness about it was, that it was not carried far enough. An arrangement was therefore made providing for a double shift key : the printing being of the lower case letters when the machine was normal, upper case letters being obtained by the depression of the upper case shift key, and figures and signs by the depression of the figure key.

The Williams Typewriter Co., in their earlier models, provided, as we shall see, for this double shift arrangement, and in their literature of those days brought forward the following argument in favour of it. The keyboard they had was as follows :

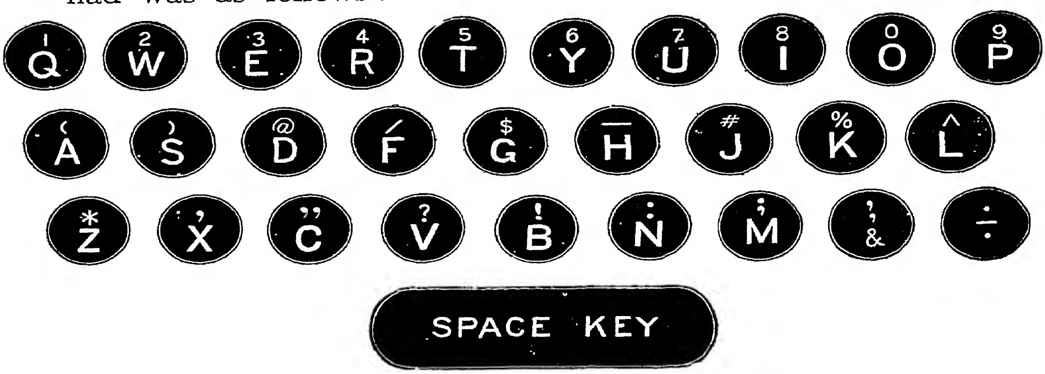


FIG 33

and they argued thus :

Mr. McGurrin, one of the most expert operators in the United States, says : " The question must be considered in reference to speed in actual work (which includes accuracy) . . . In typewriting, the speed is limited by the action of the fingers To demonstrate this, let an operator take a new sentence and see how fast he can write it Then, after practising the sentence, time himself again, and he will find he can write it much faster ; and further practice on the particular sentence will increase the speed on it to nearly or quite double that on new matter. Now let the operator take another new sentence, and he will find his speed has dropped back to about what it was before he commenced practising the first sentence. Why is this ? The fingers are capable of the same rapidity It is because the mind is not so familiar with the keys. If, therefore, the labour of the mind is added to, the speed will be decreased. Depressing the shift key on the Remington is purely mechanical. In addition to this, it requires no time. To be an improvement on the Remington, therefore, it seems that a typewriter must be invented which, instead of adding to the labour of an already overcrowded mind, will place a

larger proportion of it on the fingers. If half the number of keys on the Remington keyboard could be dispensed with by the addition of another mechanical stroke occasionally, the mind would push the fingers to greater speed than any yet attained. But a change which burdens the mind to relieve the fingers is a change towards slowness and not toward speed

In changing over to the single shift arrangement in the No. 4 model, the Williams people treated this matter very cavalierly. They stated: "It is useless to discuss the merits of the various kinds of key-boards and shift-keys. It is sufficient that the universal key-board with one shift for capitals is approved by the great army of typewriter operators The Williams No. 4 meets and satisfies the popular demand in its keyboard as in all other respects."

It would seem that given an average all round class of general work, the use of the shift key machines is to be preferred: but where figures and capitals follow in frequent succession, as in accounts and tabular work generally, then very much is to be said in favour of the double keyboard arrangement.

The manner in which the types are brought to the paper is a question which concerns the mechanic more than the operator, but a little consideration given to this subject will often prove very useful.

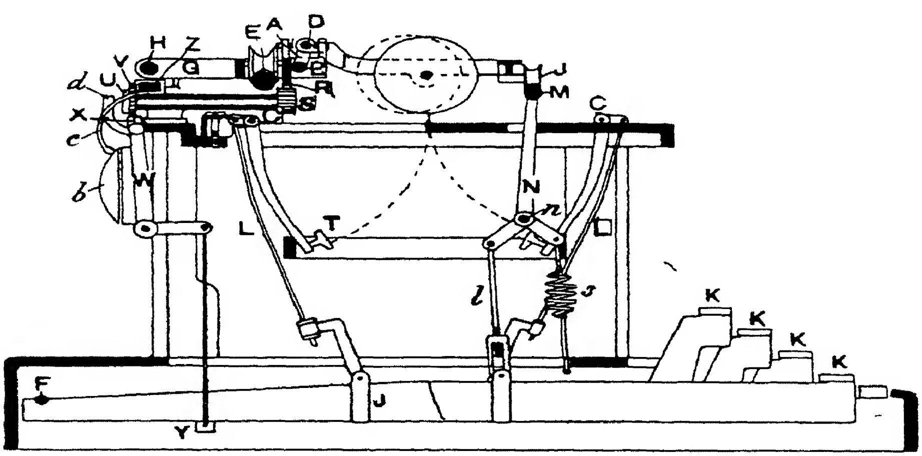


Fig. 34

To render the matter as clear and simple as possible, we have here the sectional view of a Remington Typewriter.

It will be seen that the letters K K K K denote the keys, each of which is connected, in the manner shown,

to a long wooden lever, which passes from front to back of the machine. At the further end of the lever is a slot which admits a rod or fulcrum, F, upon which all the type levers swing. The typebars are of drop-forgings. One end of the bar carries the type, the other is fixed by means of a pivot of steel wire turned I-shaped at each end. On the top plate of the machine are screwed a number of U-shaped yokes, between the ends of which the I-shaped bearings swing. The typebar is connected to the lever by means of a connecting rod or wire, so that when the key is depressed it forces down the lever, which in its turn pulls down the free end of the typebar, which thus swings on its pivot, and forces the type upward on to the platen. Towards the further end of the lever will be seen a bar, Y, which passes under all the type-levers alike, and which is also forced down when a key is depressed. This second bar, which goes by the name of "The Universal Bar," pulls down the rocking L-shaped piece, W. On the top of W are two small steel plates side by side. One of the plates, which are called "dogs," is rigidly fixed to the rocker, and merely takes the rocking movement conveyed to it by the depression of the Universal bar. The other, or "loose dog," is hinged, and is thrown forward in advance of the rigid dog just the distance of one tooth of the rack, which is a sawlike piece of metal fixed below the travelling portion of the machine called the "carriage." Now, when the rocking shaft is set in motion, the rigid dog, which has kept the carriage stationary during the "repose" of the machine, moves out of the rack, and the loose dog enters. The carriage is being constantly pulled along by the strain of the mainspring, but when the rigid dog is in position is, of course, held in restraint. Directly, therefore, the rig d dog leaves the rack, and the loose dog enters, the restraint is taken off, and the carriage moves so far forward as the movement of the loose dog will allow it to. The carriage having travelled along, the action stops, as when the finger is taken off the key the lever returns to its natural position, the rigid dog takes the place of the loose dog, and all further movement is stopped until it is set again in motion by pressure on another key.

This is the bed rock of the science of typewriter construction, and everything differing from this description is merely a difference in detail, and in no way affects the theory.

In Figure 35 we have a sectional view of the new No 10 Yost. In this machine the fulcrum is shifted from the

rear of the machine to the front, and the typebar is set in motion by the action of the compound lever at the end of the connecting wire.

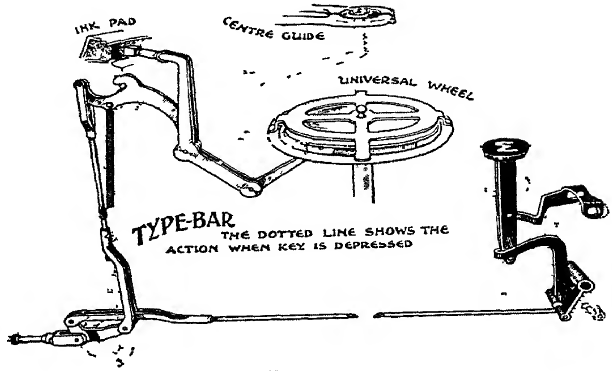


FIG. 35.

In Figure 36 is shown a sectional view of the typebar movement of the Smith Premier. In this diagram, 1 denotes the key-stem, and 2 is a round wire or shaft, which

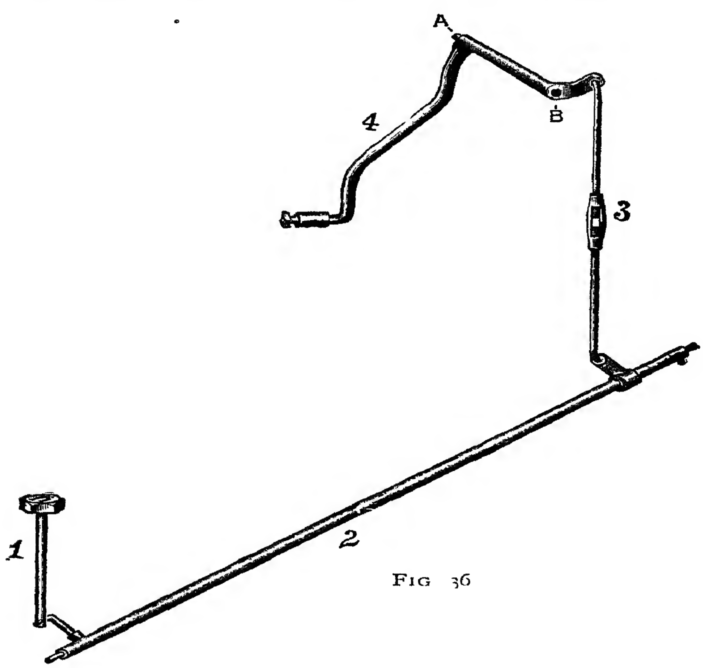


FIG 36

is connected, in the manner shown, with the key-stem. A similar connection is made at the further end with the connecting wire, 3, so that when the key is depressed, the rock shaft, 2, is made to turn round in its bearing, and,

pulling down the connecting wire, 3, causes the long bearing, A B, to turn, and so brings the typeblock to the paper.

The Remington typebar, as we have seen, is secured in a **U**-shaped yoke by means of pivots. It will be apparent that to secure permanent alignment is almost impossible, as the constant movement of the typebar in its whirling flight to the printing point has a tendency to strain the binding screw. Not only this, but the pivots themselves must inevitably wear out. The Remington and many other machines depend absolutely upon the rigidity of the bearings. The Yost, however, has a loose bearing, permitting the typebars to move in any direction. Alignment is secured by locking the typeblock at the printing point, as is clearly shown by the accompanying illustration. This does not, it is averred, cause the faces of the type to wear out by contact with the centre guide; the

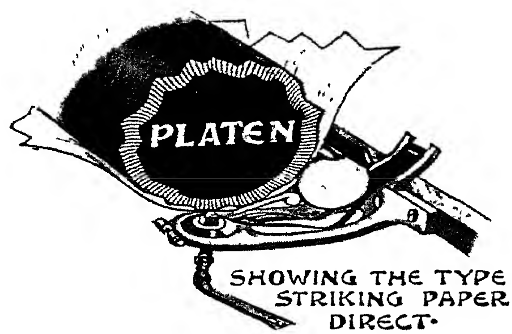


FIG 37

opening is bevel-shaped, the typeblock is correspondingly bevelled, and the type face cannot therefore strike against the guide.

There is an important point to consider in all machines, viz., the question of inking the types.

In Fig. 38 we have the ribbon movement of the Remington typewriter, in which the ink ribbon is wound on two spools, T T, on opposite sides of the machine, and the object is to feed it continuously backwards and forwards, from one spool to the other, so that it needs no attention from the operator, and, at the same time, move it transversely, so that the ink from every part of the ribbon is used up, and not from one line only. These two movements are quite distinct from one another. The first is performed by means of the shaft, S, which runs across from one spool

to the other, and which is continuously turned in one direction by the rotation of the drum containing the main-spring. The bevel wheels, W W, are arranged on the shaft as shown, so that they cannot both be in gear at the same time. When one is in gear, the ribbon will move one way ; and when the other is in gear, it will move in the reverse direction. The reversal of the direction of the ribbon must take place just at that moment when the ribbon is entirely wound off from one of the spools. To effect this there is a worm, K, on the shaft at each end, opposite the axis of the spool. When all the ribbon is unrolled from one of the spools a weighted lever, L, which normally lies in a recess cut in the face of the spool, being kept in place by the ribbon wrapped over it, falls out as shown, and in so doing forces

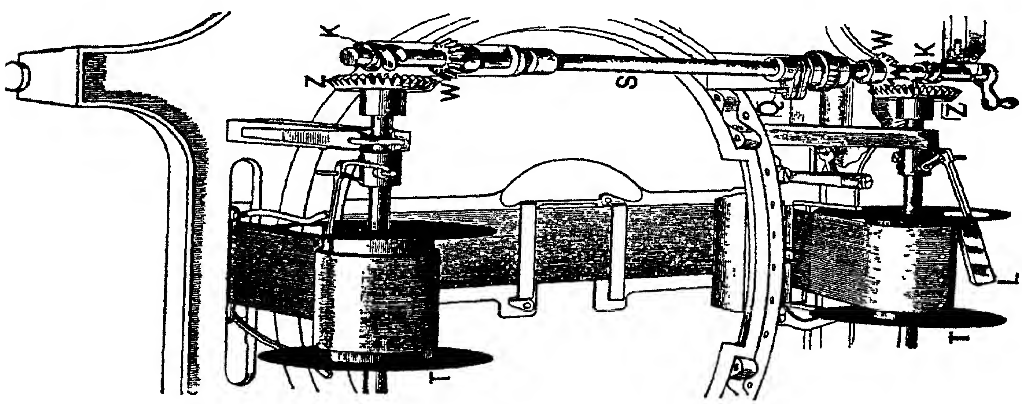


Fig 38

out of the end of the shaft a small spindle or pin which runs along the centre of the spool shaft. This pin engages with the worm, K, and the continuous rotation of the shaft thus pulls it along in the direction of its own length until the bevel wheel at that side is in gear This automatically reverses the direction of winding and the weighted lever again falls into its recess, withdrawing the pin from the worm, and the ribbon is again wrapped over it. The same thing happens at the appropriate time at the other end. The transverse motion is brought about by the stud, Q, which, as the shaft rotates, very gradually turns a cam, which pushes the ribbon frame seen in the figure, backwards and forwards, and slides each spool along its shaft. In order to illustrate the inkpad system we present a view of the typeblock of the Williams resting in its pad. This simplifies the machine to a great extent, since it obviates the

use of the ribbon gear. But the critics aver that it produces complication, hence friction, hence wear, of the typebar itself.

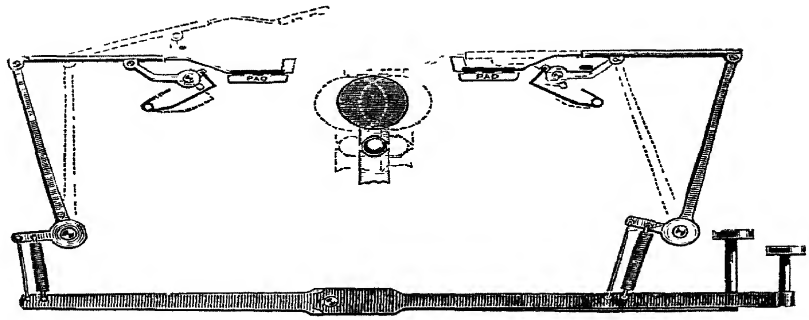


FIG 39

There are a large number of minor points to be considered, and these will be dealt with, in due course, when explaining the various machines.

CHAPTER III.

Group I.—Machines with Single Shift.

THE Sholes-Glidden typewriter (there is no "c" in the first name, as is commonly supposed) was not a commercial success. In theory, the No. 1 Remington, by which it was supplanted, did not differ very extensively from it, but where differences did occur, the advantage of them was all on the side of the newcomer. Not that the older machine was without its own special features. The carriage was not thrown back by means of a handle, as is the Remington of to-day, but by means of a long lever handle, or handtreadle, at the right of the machine. The No. 1 Remington rectified this defect by supplying a suitable handle, but, as we shall see, the awkwardness of raising the hand was felt, or imagined, and therefore, in an intermediate model, illustrated later, a ball and cord was provided for this purpose. At the left side of the machine, just underneath the top plate, was a copyholder. This, in an amended form, was repeated in the No. 1, and on reference to the illustration, the hinge joint of the appendage can be seen. Steps were taken to secure alignment, by attaching to the yoke a **V**-shaped continuation, so that the bar, when rising, was individually guided to the printing point, where, when it reached the apex, it was locked. Strangely enough, as has been already pointed out, a modification of this alignment device was the principal feature of a much later machine—the Hartford.

Once, in a spirit of investigation, we took one of these old Sholes-Gliddens to pieces. The operation, as may be imagined, was a most interesting one. The instrument seemed to have been built, "not for a day nor an age, but for all time." The machine was, following the then prevalent idea shown on all American metal work, highly ornamented with marvellous flowers, cupids, and birds of

paradise. The sides and front were all cased in, with the result that the rattle and jar of the movement were magnified, and sounded very much like a tightly braced kettledrum. In the Sholes-Glidden, the inventors seemed to have been imbued with prophetic instinct, for a lid was provided to the keyboard which, when closed, prevented tampering fingers putting things out of joint. This lid was continued in the No. 1 Remington, and the makers of the latter went one better, for they also provided a top lid which covered in the whole upper portion of the instrument.

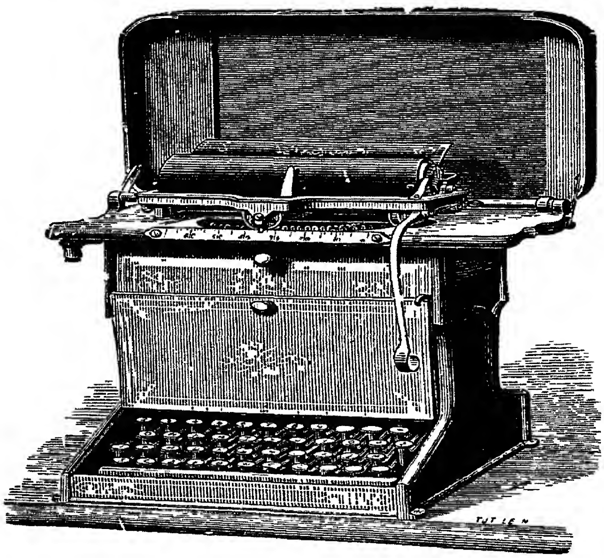


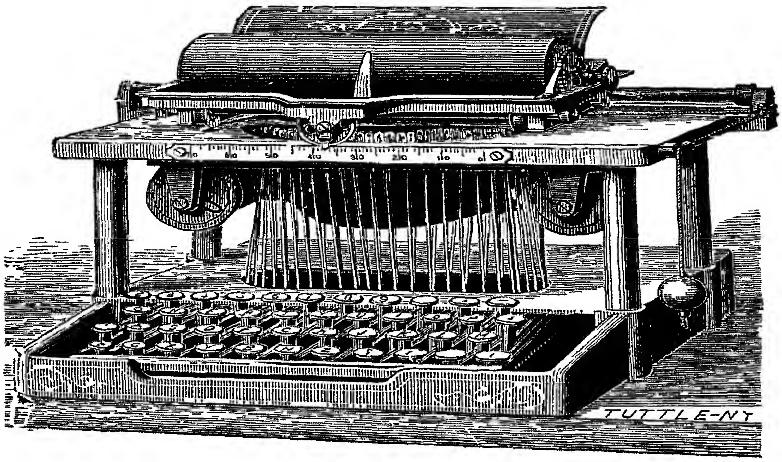
Fig 40

The platen of the two machines was very large in diameter. The type used was also small. The object was to ensure an evenly-coloured impression, as the art of curving or hollowing out the type faces, in order that they might conform to the shape of the platen, had not then been discovered.

Of the causes which led to the extinction of the No. 1 we have already had something to say. As its defects gradually became manifest attempts were made to improve upon them, and this led to the making of the model shown herewith. It will be seen that a decided step forward was made. True, this intermediate model had only capitals, but the machine was lower and more convenient. The four posts which support the top plate have no surrounding shields, the ball and pulley cord for returning the carriage is clearly shown, and its operation is so evident as to need

no explaining. The carriage closely resembles the No. 1, the keyboard is the same, but it will be noticed that the machine is longer and more squat-shaped than its predecessor. Notice, also, the base-plate covering the levers. It looks built for wear, and, judging from the illustration,

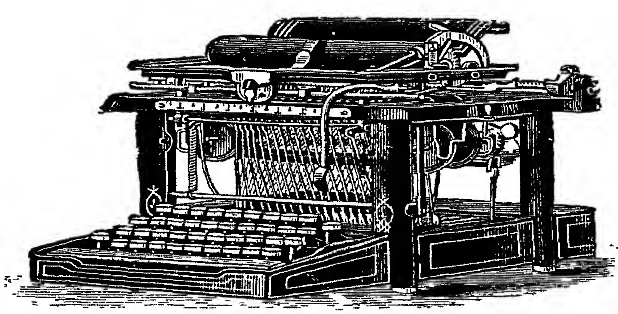
FIG 41



appears to be a tower of strength. We do not remember at any time having seen an illustration of this model in any publication relating to the typewriter, and the reader may therefore well appreciate the advantage of finding something really new in these pages.

The No. 2 Remington seemed for a long time to be all that could be looked for in a typewriter. The introduction of the shifting carriage, operated by a small key alongside the others on the keyboard, at once doubled the capacity of the instrument. The great objection which many people felt to typewritten work was immediately swept aside. The machine at last rivalled the pen, and the impetus which the new model gained has never been lost. Considerably over 100,000 machines of the No 2 model were sold. Many

FIG 42



of them are in constant and heavy use to-day. Here and there an old veteran of the early days of the machine is to be found, who will declare that as a perfect instrument the No. 2 Remington has never been improved upon. It made a noise, and the touch was by no means light, as we measure typewriter touch to-day, but it did its work, did it well, and the speed was equal to all emergencies. What more can be said for any machine ?

The No. 3 Remington was introduced in order to meet the requirements of the English market. It was very soon found, after the machine had been submitted to the public

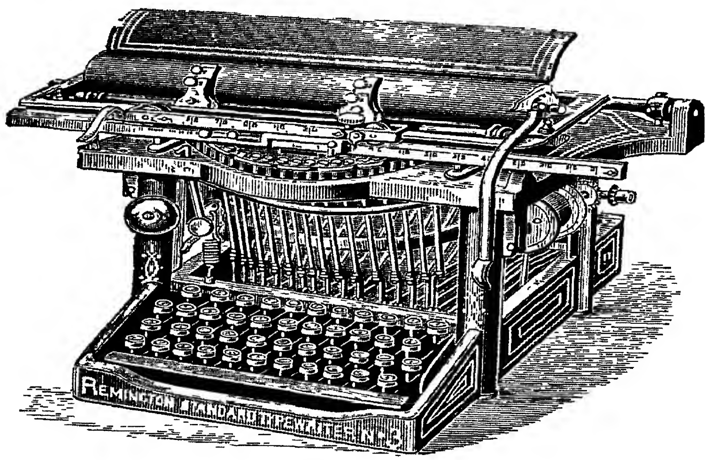


FIG 43

approbation in England, that one of the greatest class of users would be solicitors, and others using much wider paper than is usually employed in the United States. Generally speaking, it followed very much upon the model set by the earlier machine, using the shift key, and so on, but there were a number of mechanical and other points of difference, chief among which were the following :—

(1) The rack is reversed, so that its teeth point upward, instead of downward.

(2) The rack is made to rock, instead of the dogs.

(3) The dogs are above the rack, and travel along it

(4) In the No. 2, in returning the carriage, the rack has to be lifted clear of the dogs. In the No. 3 the carriage is pushed along, without troubling about dogs or rack.

(5) The carriage is narrower, and lighter in proportion.

(6) There are four extra keys, yielding eight additional signs, and besides these, there are several other improvements. The general principles of the machine, however, are identical with the No. 2.

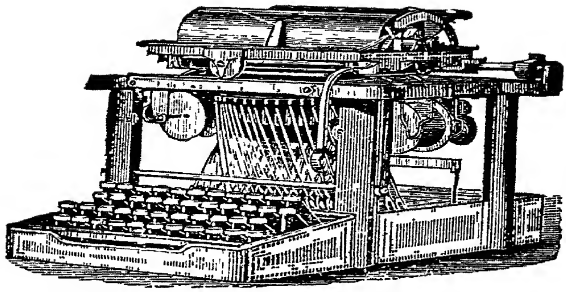


FIG. 44

The No. 4 Remington. This machine, no longer catalogued, was an improvement of the No. 1 on the basis of the No. 2 machine, and employed only capitals.

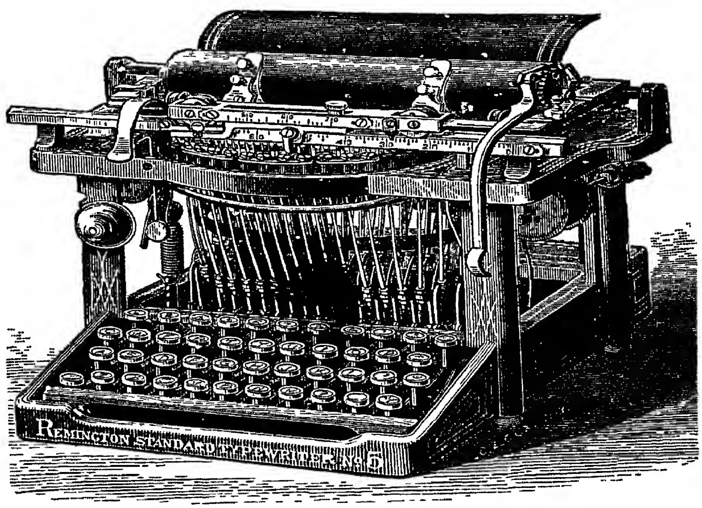


FIG 45

The No. 5. This is a foolscap machine, specially designed to meet the English market. As will be seen by the illustration, it is built generally on the lines of the No. 3. It feeds paper 9½ inches wide, and writes a line of 7½ inches. It has the same keyboard and arrangement of keys as the No. 3.

The No. 6 is an up-to-date improvement on the No. 2 (employing the No. 2 keyboard), and is sold in America, whilst the

No. 7 is a similar improvement on the No. 5 and incorporates, according to the official catalogue, the following important improvements :—

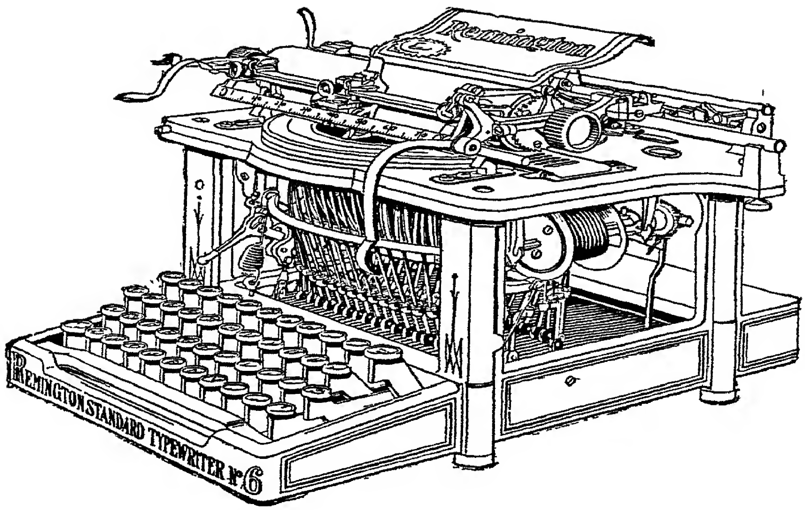


FIG. 46

A new escapement, which gives unprecedented speed powers, soft, light, and pleasant touch, and absolute precision in work.

A new arrangement of the typebars, which ensures perfect and permanent alignment.

A new paper-feed, rendering it possible to write on wide or narrow paper, envelopes and post-cards, with equal facility. Paper can be inserted by a single movement of the hand, without lifting the carriage, and can be fed in either direction by simply turning one of the cylinder handles. New paper-guides displace the rubber bands ; these can be adjusted to any point desired without unscrewing.

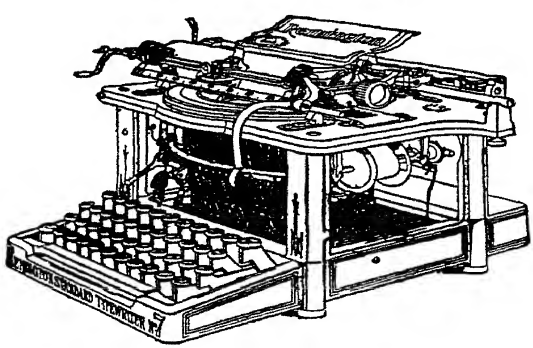


FIG 47

The No. 7 has a wider, lighter, stronger, steadier and more convenient carriage than any previous machine.

The ribbon mechanism is entirely automatic, reversing

and giving lateral movement to the ribbon, without aid from the operator. Time is thereby saved, and the durability of the ribbon increased.

The margin-stops are instantaneously fixed by a touch at any point desired.

A new device was incorporated for the writing of marginal notes without specially adjusting the margin-stop.

The new keyboard lock renders it impossible to depress any key after the end of the line has been reached, thus obviating the writing of several characters on one another.

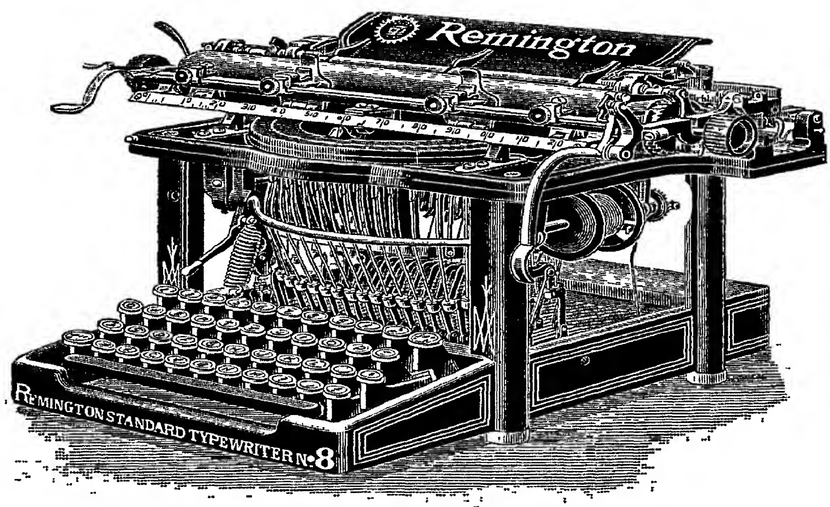


FIG 48

The No. 8 Remington is the brief-sized machine. In all essential particulars it resembles the No. 7, saving that the carriage is longer. Owing to the weight of the carriage, and the consequent increased tension necessary to pull it along, there is necessarily a much greater strain on the escapement device in all brief machines. An improved form of escapement is therefore now being adopted for the No. 8 machine.

Although its general form was settled so long ago, the Remington has been surprisingly capable of adapting itself to new devices. The tabulator, the loose leaf devices, the card attachment, the marvellous power of the Remington as a stencil cutter, all these and many other features render it essentially an up-to-date machine, on which the lustre of perpetual youth would seem to sit. The proprietors' boast that the machine has never seemed to them to be too good for improvement has made the Remington what it is

to-day. And such a forward and enlightened policy must ever aid them in assuring and maintaining their proud position.

The firm of Wyckoff, Seamans & Benedict were originally selling agents for the machine. On the liquidation of the Remington Small Arms Company, however, they obtained control of the machine. The firm then bore the names of the proprietors, but of late years the style of the Remington Typewriter Co. has been brought prominently to the fore and the concern is now known by that name.

The English Remington.

This machine requires, even if it does not deserve, mention in this record. In the early days of the Remington machine in this country, it was handled by a firm of agents in the City of London. When their agency was determined, certain of the earlier patents had expired, and they accordingly set to work, and produced a very crude form of machine, to which they gave the above title. The commercial career of this machine was, however, very early nipped in the bud. According to the announcements at the time it was twenty-five per cent. cheaper than any other typewriter having typebars, from which it will be seen that the price at which it was offered was sixteen guineas Examples of this machine may still be occasionally found offered for sale, but they should be carefully avoided. They may be distinguished from the genuine article by the extreme roughness of the castings and finish, and by the absence of the patent marks so prominent on all genuine machines. They might have been capable of doing good work, but although two or three of them have fallen into our hands at different times, we have never met with one capable of maintaining its alignment even when operated at very slow speed.

The Manhattan Typewriter.

The No. 2 Remington has also been resuscitated (if such word can apply to a machine that has never been dead) under the above title, by a corporation calling itself the Manhattan Typewriter Co., whose works were at New Jersey. According to the official announcements, this machine was not intended to be radically different to other machines, but was built on familiar and approved lines of strictly high-grade construction, more durable, and at a lower price than was charged for other competing standard machines. The most complete and elaborate plant was

laid down, and arrangements were taken to place the machine on the market in this country. It fed paper nine inches wide, with a writing line of seventy-two characters, it had the universal keyboard, with forty-two keys, governing eighty-four characters. It was well and substantially made, and

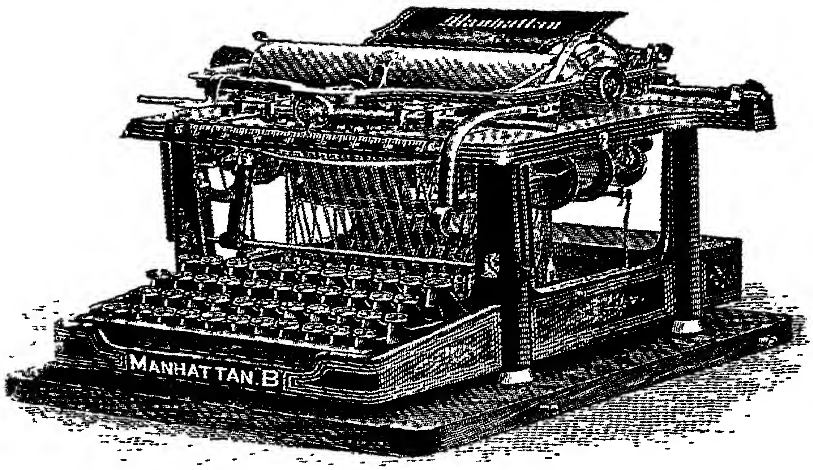


FIG 49

certainly capable of doing its work. For some reason or other, the machine did not secure a foothold in Great Britain, and was, after a time, withdrawn from the English market. It still has a following, however, on the European continent, and we are given to understand that at some future time, it will probably be launched in this country again

The Fox Typewriter.

Here again we have a machine which, although differing more widely from the No 2 Remington than either of the foregoing, may yet be regarded as a development thereof. It was placed on the American market some seven or eight years ago, and in the early part of 1903 steps were taken to plant it in this country. A very large and extensive establishment was taken in a most out-of-the-way place for a typewriter concern, namely, the Westminster Bridge Road, London, S.E. The agency, calling itself the Fox Typewriter Co., was a selling agency, under the control of a gentleman who had had a most extensive connection with typewriters, and had met with a great amount of success in placing the Fox throughout India. However, it soon disappeared from view. The headquarters of the manufacturing concern are

at Grand Rapids, Michigan, U.S.A., and according to the prospectus, the makers claim to have a machine which will answer the demands of the most exacting operator, and which, being built upon well-tried principles, will not involve any experimenting with at the expense of the operator. Its essential features are stated to be its light-running powers

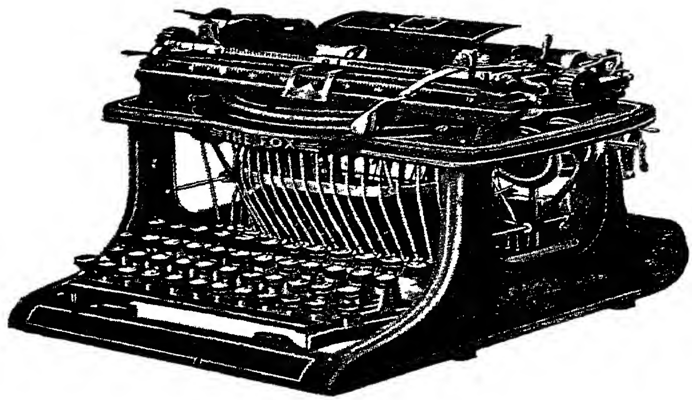


FIG 50

(in consequence of which it was dubbed "The Light-Running Fox"), brought about largely by the free introduction of ball-bearings at many of the frictional points, the carriage especially being supported on and guided by hardened and ground steel balls. It also had a peculiar form of escapement, which was called the speed escapement. By the turn of a small lever, the ordinary method of escapement was thrown out of gear, and the secondary one brought into play. To understand the effect of this, it will be necessary to ask the reader to try a little experiment. If he will place his finger on any key of an ordinary machine, he will notice that, in the first place, the type rises (or falls) to the platen. When pressure is released, the type falls to rest, and the platen moves. It will thus be perceived that the sequence of events is, 1st, depression ; 2nd, release ; and 3rd, movement. But with the speed escapement, the carriage moves simultaneously with the depression of the key, so that movement and depression proceed together. When impact is complete, and the pressure taken off the key, the carriage has already shifted, and will remain still until the next key is struck. It will be seen by this that the time which would otherwise be occupied by the movement of the carriage is not required, and that the caution, so strongly insisted upon, to await the return of one key

before depressing the next, is not required when the machine is set for "speed." But unless the operator has a rapid and very steady touch, there will always be the risk of the carriage movement extending to two or even more spaces. The makers, in fact, do not advise the use of "speed" by any other than really expert operators. Be this as it may, it finds considerable favour in the land of its birth, although English typists may well be rejoiced at escaping this further strain.

Moreover, in the Fox, each key was capable of an individual tension, and, according to the literature issued on behalf of the machine, it was considered that this variable tension presented the true solution of touch-typing, as, with every key varying in the amount of pressure required to bring it to the printing point, the operator would know, at once, whether the key he depressed offered too much or too little resistance.

Several forms of the Fox were made. One had eighty-eight characters with the foolscap platen. Another accommodated paper $16\frac{1}{2}$ inches wide, with a line of writing 140 characters long. Another had only seventy-eight characters, and there were others.

The machine was equipped with all the usual devices for margins, margin releases, etc., and it was a good manifolder and stencil cutter. The ribbon movement was purely automatic, and the machine itself presented a handsome and very solid appearance.

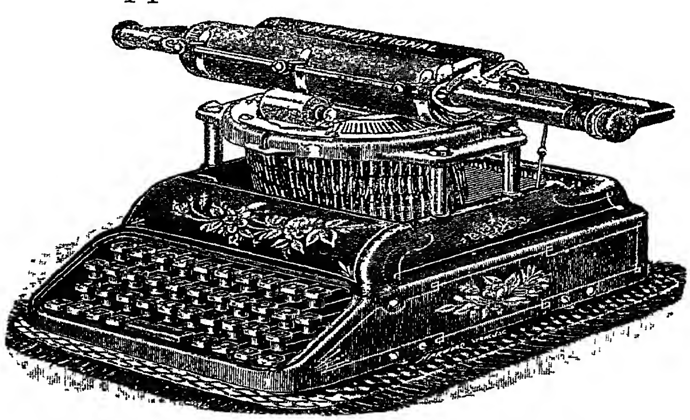


FIG 51

The International Typewriter.

This machine presented a number of very peculiar features. It was, in the first place, exceedingly massive. It had the universal keyboard, and the types were so arranged as to strike upwards in grooves to the printing point.

The ribbon differed, also, in its movement from that on any other machine, since it was made to pass from front to back of the machine. The International was the earlier effort of Mr. Lucien C. Crandall, whose later work, the type-sleeve machine bearing his own name, we shall refer to later on. *The Phonographic World*, of New York, on one occasion apostrophised Mr. Crandall somewhat in the following terms :—" Mr. Lucien C. Crandall, whose two typewriters, the International and the Crandall, had led to the invention by stenographers of more swear-words than all the other typewriters combined ! "

The Cleveland Typewriter.

The Cleveland Typewriter, sometimes called the Hartford No. 2, or Hartford Shift-Key machine, was the first machine to be placed on the market, at any rate in England, in two distinct forms, that is, with or without a shift-key. True, the Hammond had already appeared in two forms, in which the Ideal and Universal keyboards, the former curved, and the latter straight, were used, but the Cleveland-Hartford machines were just the same in every respect,

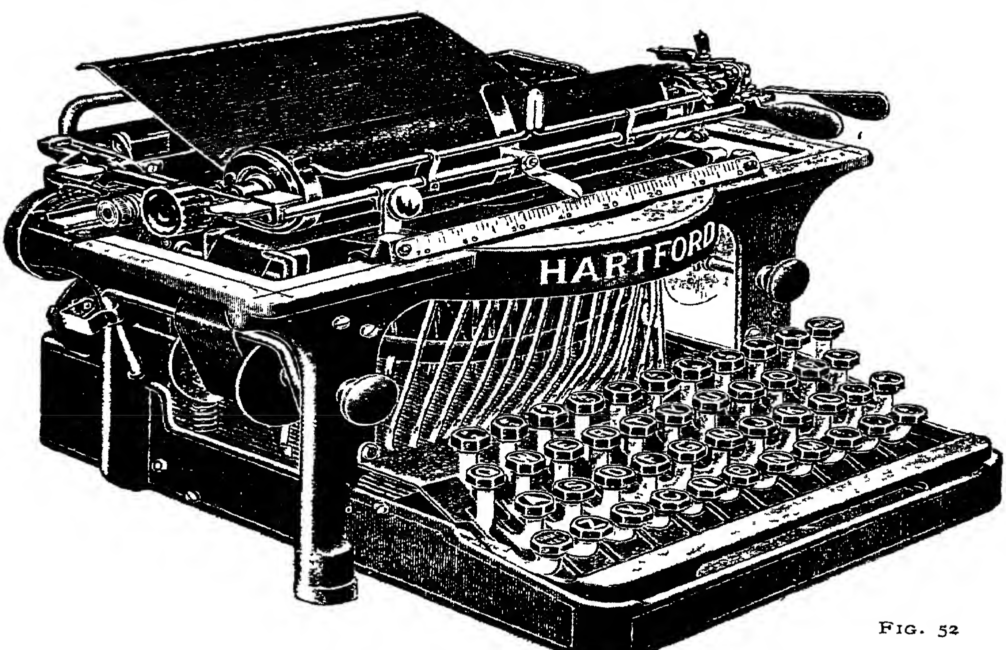


FIG. 52

saving that the one was made with, and the other without the shift-key device. The first instrument offered for approval was the Hartford, the double keyboard machine,

and we refer the reader to the section dealing with these machines for a fuller description of the Cleveland.

The Remington Sholes.

(Afterwards called the Fay-Sholes.)

This machine is also a descendant of the Remington, and its patentees are a Mr. Remington and a Mr. Sholes, who originally combined the first portions of their names into the title "Rem-Sho," which they gave to the machine. But as it was considered that the use of this term was likely

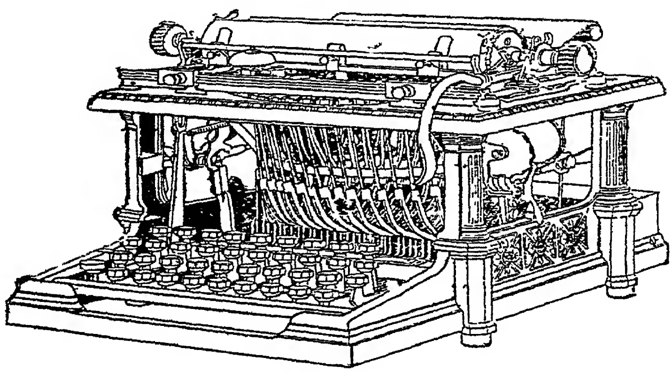


FIG 53

to mislead the public, the second name, Fay-Sho, was applied. The machine is sometimes called "The Typewriter with the Japanese name" As the inventors are descendants of the inventors of the first machine, the Company suggest that, if horses and dogs are bought by pedigree, the same plan might well be adopted in selecting a typewriter.

The essential features of the Fay-Sho (if we omit reference to the minor matters of embellishment) are two in number. It is a shift-key machine, the same as the Remington, but the depression of the shift-key does not affect the carriage in any way, but shifts the whole of the type-basket. The makers say:—"In order to change from lower to upper-case, the basket is brought forward on ball-bearings by pressing the shift-key. If it is desired to print all capitals, the basket is shifted and automatically locked, and upon being released returns to its original position for small letters, and is also locked in this position The result of this arrangement is that it keeps all the writing parts in the proper relation to each other, thereby maintaining the perfect alignment for which the Rem-Sho is noted."

The second point of peculiarity is that on one and the

same machine various lengths of carriage may be used, "thereby increasing its general usefulness, and virtually combining four machines in one." Of course, the interchangeability of carriages is no novelty, but in other machines it is necessary to have an instrument made to the size of the largest carriage to be used on it. Thus, a foolscap machine may serve its purpose two or three or even more years. Should, however, brief work suddenly loom in sight, the original machine becomes useless. But with the Fay-Sho, longer carriages may be subsequently acquired, and made full use of, although at the time of purchase no thought existed that anything larger than a post-card would ever be required.

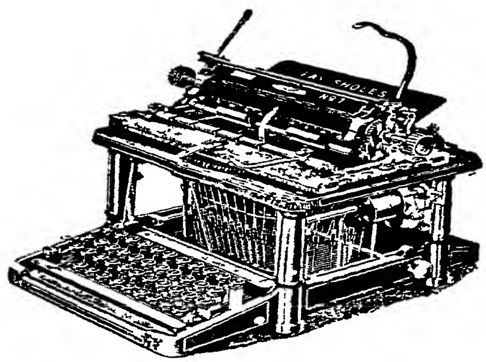


FIG 54

Among other features of the Fay-Sho may be mentioned the following :—

A platen pointer, which relieves the operator from the necessity of consulting front or platen scales in referring to work or in making corrections.

The marginal stops are fixed to the front of the machine and are easily and quickly adjusted.

A jumping or tabulating device forms part of the machine, and operates rapidly and accurately without jar or risk of damaging the dogs

The ribbon is NOT automatic in the reverse movement, the makers considering this not to be a good feature Their judgment in this respect differs from that of all their rivals. But before the ribbon has completed its complete travel from one spool to the other, there is a "reverse-your-ribbon" signal, which appears in the front of the machine, and thus gives the operator timely notice that his attention is required.

The accessibility of parts, as well as the solidity and strength of the typebar hangers ; the conveniently arranged paper fingers are also very noticeable and valuable features.

The machine is equipped with the usual devices for writing on ruled lines, and for changing the line space, and the carriage can be released from either side, as may be desired or more convenient.

Fig 55

The Densmore.

The essential feature of the Densmore typewriter, when first submitted to the public, was its supplemental type-bar, as shown in the accompanying figure. It is pointed out that the force of the finger raises this bar and enables the principal bar to gradually overcome the resistance or inertia which, in other instruments, can only be overcome by a sudden strain or jerk. The secondary bar slides upon the principal bar with gradually accelerated speed and force, and, taking off all lateral

strain, permits the principal bar to rise with unvarying accuracy.

Another peculiar feature of the Densmore is its great rigidity and strength, the result of the framework being made in one solid casting. There being no screws or joints in the framework to get loose, there can be no twisting, warping, or other defect, and so the whole machine remains as tightly braced together at the end of many years' constant use as it is the day it leaves the factory.

It will be observed that the keyboard of the Densmore follows what is termed the Standard arrangement, but particular attention should be paid to the duplicate shift-key, enabling the change of case to be made by either hand, as may be more convenient, and to the "back-spacer" key, upon which the Densmore people set great store. The effect and value of the key will be readily understood. Every time the key is struck, the carriage goes back one tooth in the rack. Under ordinary conditions, when too much space has been left, or the space-bar inadvertently struck, it is necessary to leave off writing, and raising the hands to the carriage, gently coax it back to the required position. And everyone knows how tedious this operation is. It generally happens that instead of one tooth we send it back two or more teeth, and then have to space forwards again by means of the space-bar. If we assume that we have sent it back twice, and space once to make sure, then we find that it was in the proper position, and that after all we have left a double space.

Almost from the earliest days of the career of the Densmore, a great point has been made of its ball-bearing type-bar, as seen in the illustration (Fig. 56). The wear and tear of the type-bars in their hangers has always presented a difficult problem for the typewriter inventor. We shall see how adjusting screws have been provided, and how forced alignment has been adopted in order to remedy an evil which it has been considered must of necessity arise. But in the Densmore, it is claimed that the difficulty is surmounted by the introduction of these ball-bearings, and certainly, from an inspection of work executed upon a Densmore of several years' constant use, we consider that there is much to be said in support of the makers' contention. As an example of the practically unlimited wear they afford, it is stated that the first model of the ball-bearing type-bar was used for a year at hard work as a test before adoption (in 1895), and

held its alignment perfectly. An examination of the type-bar joints at the end of that time showed practically no wear or play A further very exacting test was then given them, the type-bars being set to work by machinery, and being made to strike upwards of two million blows. The test was regarded as the equivalent of three years' very hard work, and again no wear was perceived.

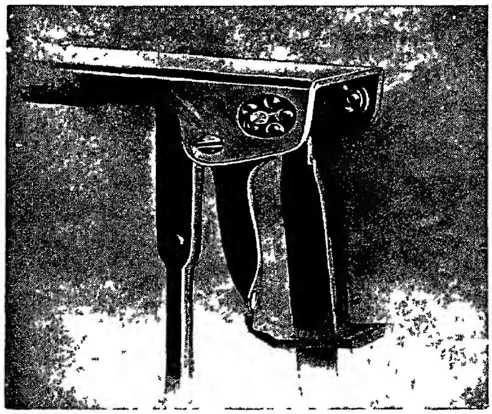


Fig 56

After this it was decided to introduce ball-bearings wherever they could be introduced to advantage, and as a result the makers now say that the machine "bristles with balls all over."

The carriage of the Densmore is exceedingly light, and moves speedily with very little tension. Again, ball-bearings have been brought into use, and this aids in its light running powers. The carriage does not lift, but the platen is made to swing forward, so that the writing is brought into sight in a moment. The platen is so made that it can be lifted off the machine, carrying with it an unfinished piece of work, and another platen substituted for any special requirement, such as stencil cutting, manifolding, etc.

There is a graduated scale on the paper table, which will permit the paper always being fed in at the same relative position, thus securing absolutely even margins. Facilities afforded for throwing the line spacing out of gear, and the pressure of the feed roll can be lightened in order to permit of the adjustment of paper, or the insertion of a number of thicknesses for carbon work. The feed roll automatically adjusts itself by the mere act of swinging the platen into its normal position.

Every care has been taken to secure the escapement of the Densmore being rapid and sure. Running as the carriage does on ball-bearings, and with low tension, and being itself very light and well-balanced, there is very little resistance to be overcome, and speed is thereby assured.

The original features of the Densmore are not, however, yet exhausted, for particular attention should be directed to the "justifier," a device which, we believe, finds no exact counterpart in any other machine. This is a sort of gauge, by which the paper can be moved to the left for any portion of a full space. As is well-known, the space occupied by a letter is one-tenth of an inch. But it may so happen that the space available for writing upon is just one letter too little, that is to say, four letters are required to be written in a space which can only carry three letters under ordinary conditions. To meet such instances, it has been the custom to break the word, if a disyllable, or leave an unsightly gap, and type it in the next line. But this device gets over the difficulty, and the four letters can be compressed in the shorter space. Even the most perfect operator will make a mistake now and then, and only finds it out afterwards. A mistranscribed outline, such as *me* for *him*, *can* for *come*, and so on, will require correcting. It would require a lot of manœuvering in ordinary circumstances to make this correction in a sightly manner, but with the justifier to assist us, we erase the error, and a little bit is taken off the tenth of an inch occupied by each letter, and saved up to the last, when it will be found that the accumulated savings will just accommodate the new letter. This device, in conjunction with the pointer (see illustration), will render corrections of all kinds a very easy matter.

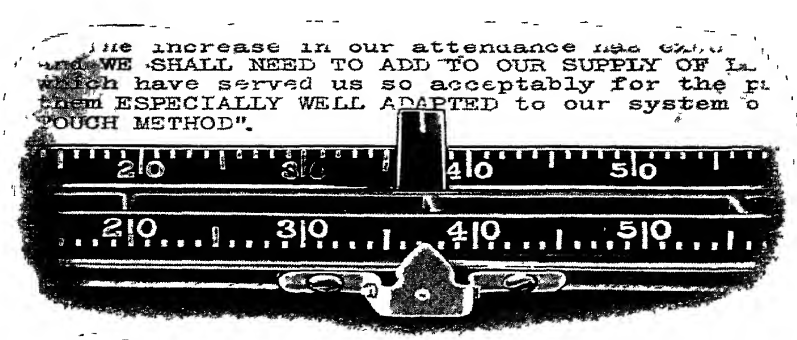


FIG 57

The paper fingers are very effective, and grip wide or narrow paper well. The card platen and marginal stops are also very good features, and it is claimed that the models of the Densmore in use to-day include every device which has been found practicable either to increase the range of typewriters, or reduce the labour of the operator.

Group II.—Machines with full keyboards.

The Caligraph.

We have already (page 46) referred to the introduction of the machine now under notice. A double keyboard having been decided upon, the next step was to secure the improvement in the carriage, for even in those early days it was seen that lightness was an essential precedent to speed. An entirely new model of carriage was therefore provided, and so light was it, that ultimately the lifting weight was only about eight ounces. It will be noticed, on reference to the illustration, that the front portion of the Caligraph is occupied by a sloping desk upon which the operator might easily support his arms. The object of this desk, however, was no such humanitarian idea, but to enable the levers to be lengthened in front, and the fulcrum was placed towards the operator instead of from him. A lever so constructed is known mechanically as one of the second order of leverage, and as we shall see in this section, it is interesting to find, long after the Caligraph was withdrawn from the market, that the same idea was incorporated in another machine—the No. 10 Yost to wit. So light was the leverage which resulted, that the keys required a depression of not more than $\frac{19}{64}$ths of an inch in order to bring the types to the printing point.

The mechanism governing the movement of the carriage was altogether different to that of the Remington. Instead of a coiled spring in a drum pulling a strap attached to the further end of the carriage, we find in the Caligraph a long spiral spring mounted on an iron bar, and passing from front to back of the machine underneath the key-levers. This spring, which could be adjusted to a remarkable degree of fineness, was attached to a long driver arm at the rear of the machine, and the arm, in its turn, was attached to the carriage. The result was that a far more uniform movement of the carriage was secured, for it must be quite clear that the tension

of the mainspring is very different when the carriage is in a position to write at 1 on the scale, to what it is when 65 or 70 is reached. This fact has been taken into consideration in many machines, and we shall find hereafter that in the National, the Ideal, and so on, means have been taken for securing a centre-driven carriage.

The escapement was also re-modelled. Instead of having two dogs, one rigid and the other loose, playing in a single rack, the Caligraph introduced a single dog,

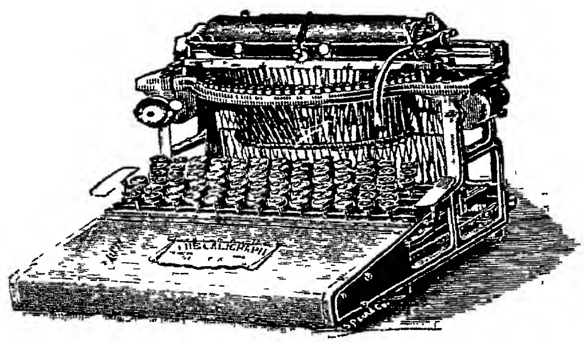


Fig. 58

working between two racks, the one loose and the other rigid.

The space-bars, also, were a novelty, and were probably the first serious attempt to bring about an all-finger style of operation. Two such bars were provided, one at each side of the machine, and it was intended that these should be depressed by the little fingers.

The type-bars were provided with adjustable nuts and bolts, for taking up wear and recovering alignment and in the later models an improved ribbon feed, permitting of a lateral as well as a sideways action was used.

It is interesting, also, to note that the platen of the Caligraph was not round, as in the Remington, but was planed off into a series of facets. The object was to secure a flat surface for a perfectly flat faced type to strike upon. Later inventors got over this difficulty by hollowing out the type so as to make them conform to the curve of the platen.

The Caligraph was made in several numbers, and an old No. 1 in our possession seems to justify the title being given to the machine of "The machine that won't wear out." This machine used capitals only, but others incorporated full keyboards.

We have referred already to the keyboard of the Caligraph. This was, undoubtedly, its failing, but the makers were always willing to arrange the types in any manner desired. But the Caligraph was too large and unwieldy an instrument to secure the highest degree of popularity, and the numerous connecting wires contained in its open frame presented a very spidery and bewilderng effect.

After making a very plucky fight for years. the Caligraph was withdrawn about 1898, and its place was taken by the New Century Typewriter, of which full details appear later on.

The Yost Typewriter.

The most interesting part of the Yost Typewriter is probably the great success which it has met with in the English market. Representing, as it does, the latest and most matured thought of G. W. N. Yost, whose demise in the year 1895 was recognised as one of the most serious losses the typewriting world had so far sustained, it embodied everything which his extended knowledge of the requirements of typists deemed desirable, and his great skill as a mechanist enabled him to develope.

He had seen that the shift-key did not meet with universal approbation, and that the support accorded to the Caligraph proved the demand for a full keyboard. When, therefore, he began the construction of the machine to which he gave his name, that feature, the double keyboard, was one of the first considerations to which he devoted attention. He had marked the thickened and blurred appearance which the ribbon (by no means so perfect in those days as in ours) gave to the writing, and there can be little doubt that his attention had been drawn to the finer work of those Index machines, which we shall presently deal with and which took their ink from a moist pad. He therefore decided to incorporate the doctrine of direct-inking. Moreover, in spite of all efforts to secure good alignment, he had observed that type-bar bearings would wear loose, and to surmount this difficulty, he went back to the device of Francis, and used a centre-guide which should lock his types all round at the printing point, and so force them to print in a true line. Finally, he incorporated the simple device of a pointer, which should invariably denote where the next letter would print, and so render scales almost unnecessary.

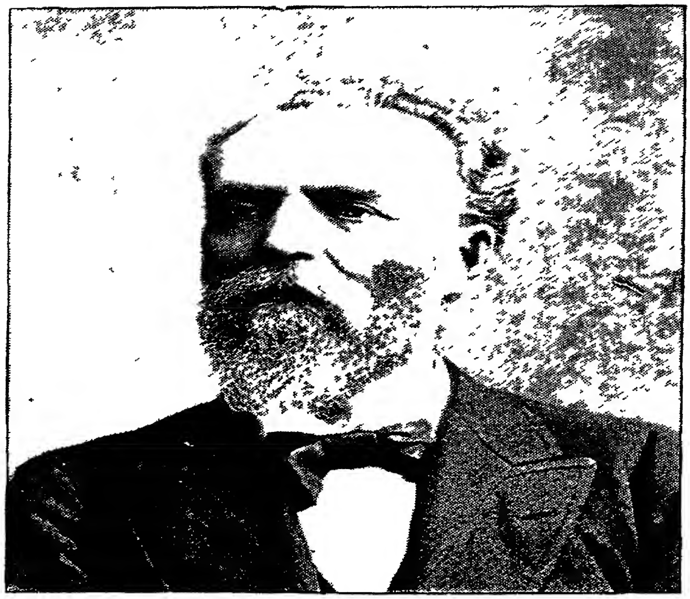


Fig 59

The first model of the Yost was made in 1888, but it was not until two years later that it was submitted to the public. Although its general outlines were very much the same as its predecessors, yet it differed from them in many very important respects. The net work of connecting wires and levers which, to the uninitiated, convey such ideas of complexity and complication in other machines (although such ideas are generally wrongly formed) were hidden from sight, and protected from dust and curious and meddlesome fingers by sheaths placed all around the working parts. These sheaths were, however, capable of being removed for cleaning purposes, or when the maximum of quietness was desired

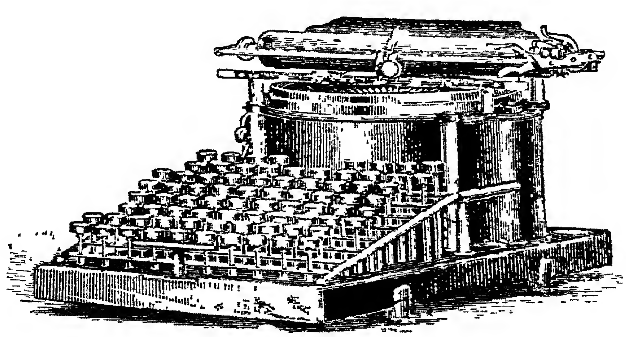


Fig 60

The pad from which the ink supply was derived was contained in a metal case, which fitted closely round the top plate of the machine and the types, when at rest, lay imbedded in this pad. It is a curious fact, little known to Yost operators of to-day, that in the earlier models, this pad was made in two portions, but this duplex arrangement soon gave way to the single pad. Moreover, it is interesting to note that the earlier models of the Yost were made with a variety of keyboards, that is, the keys were arranged in such ways as to suit old-time operators of the Caligraph, the Hammond, or the Remington, the latter, of course, being in duplicate.

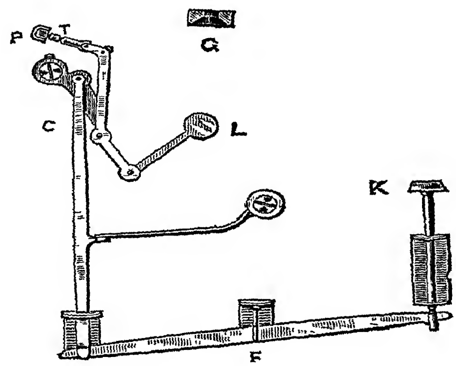


FIG 61

The accompanying sectional view of the type-bar of this early model will interest those who like to know how the machine worked. On the depression of the key, K, the key lever, F, is pressed down at the key end, and, swinging on the central fulcrum shown, is raised at the type-bar end This movement pushes up the connecting rod, C, causing the type, D, to leave the ink-pad, P. The movement of the type can then be easily followed, as it finds its way to the guide, G. The link-holder, L, is a fixed point, and it is this that gave the machine its peculiar and rapid stroke.

The centre-guide has been the subject of a great many discussions. The opposing party say that absorbs power, that is, that part of the force of the blow is dissipated the moment the type comes in contact with the guide, and that consequently, either a heavier blow was necessary than need be to secure a good impression, or that the impression was not perfect. It was considered, also, that ink was taken from the type-face and gathered round the guide, which afterwards found its way on to the

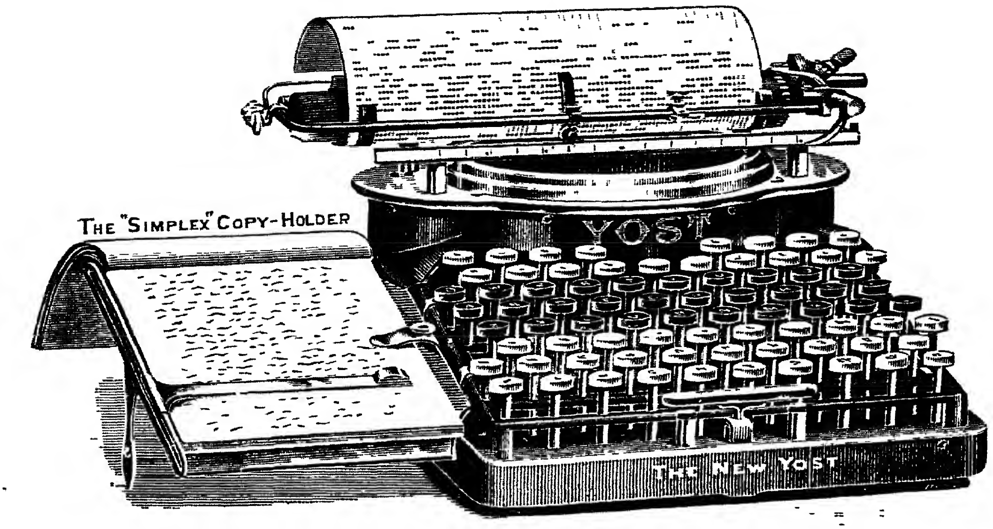


FIG 62

paper. But the fact that the Yost has stood its ground for so many years shows that the objection does not appear to be well founded.

The pointer, which was a hinged plate fixed to the framework of the machine under the carriage, was a revelation in simple devices; and one has only to point to the large number of machines which have since adopted a similar device to be assured of its use and value.

The No. 1 was followed by a model called "The New Yost," in which a different form of escapement was used, and various other improvements added to the carriage. The square corners were literally and truly rounded off. No. 3 was the brief-sized model.

The No. 4 Yost occupied the field for many years. It had seventy-six keys, retained all the good features of earlier models, and introduced a keyboard lock, improved the marginal arrangements, then adopted sliding and adjustable paper fingers, and many other devices. It was a stately machine, capable of being operated at very high speeds. Nos. 5, 6, 7, 8, etc., were identical machines in every way, saving that wider carriages were used.

The ability to remove the carriage from the Yost, a feature which was employed from the earliest models, rendered the substitution of a smaller carriage an easy matter. Thus, a brief machine could be adapted to foolscap work, with the convenience that unfinished work did not require removal. As mimeography grew

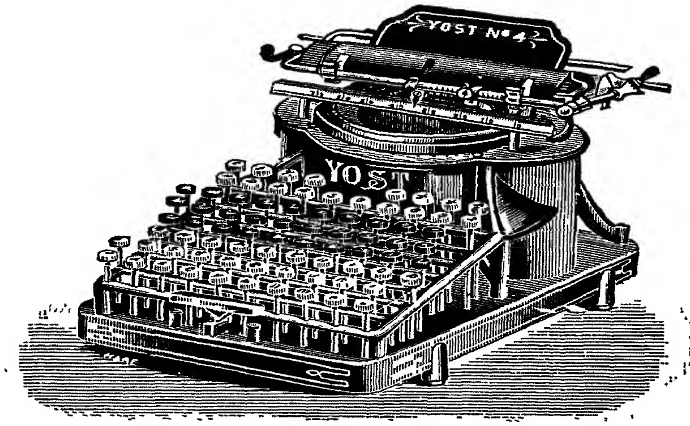


FIG 63

into popular favour means were adopted by the use of what was termed "sharp-faced type," to secure the finest class of work. It should be pointed out, that where a machine prints direct without the intervention of a ribbon, a flatter surface is required in order to secure evenness of inking, as well as to avoid cutting the paper. This sharpness exists on all ribbon machines, because its effect is lost when it comes to strike through the ribbon-fabric. The sharp-faced type, therefore, was specially suited to ordinary work in addition to mimeography.

After continuing in popular favour for many years, the No. 4 Yost gave way, in the autumn of 1902, to a highly improved model called the No. 10.

In this machine, the peculiar features which had distinguished the Yost from its competitors were retained. Additional facilities were provided for the insertion and removal of the ink-pad, and the keyboard was enlarged by nine characters, thus permitting of the minor fractions and various other commercial or literary signs being provided.

The carriage was made removable by the mere act of depressing a couple of plungers, when it came off bodily in the hands. The centre-guide was improved in shape and design, a special marginal release key provided, and an entirely new plan of margin stops, by means of collars sliding over a rack-bar incorporated. Moreover, the margins which had always been a slight source of worry, owing to the tendency of the carriage to rebound when sent back sharply from the end of a line to commence the next line, were now made absolutely perfect, and no trouble whatever arose from this score. The key-tops

were made removable, and were altered in shape. The carriage, also, was made to run on ball-bearings, and so slightly was the tension required to be adjusted, that the friction proved to be imperceptible, so much so, in fact, that the No. 10 assumed the title of "The Light Running Yost."

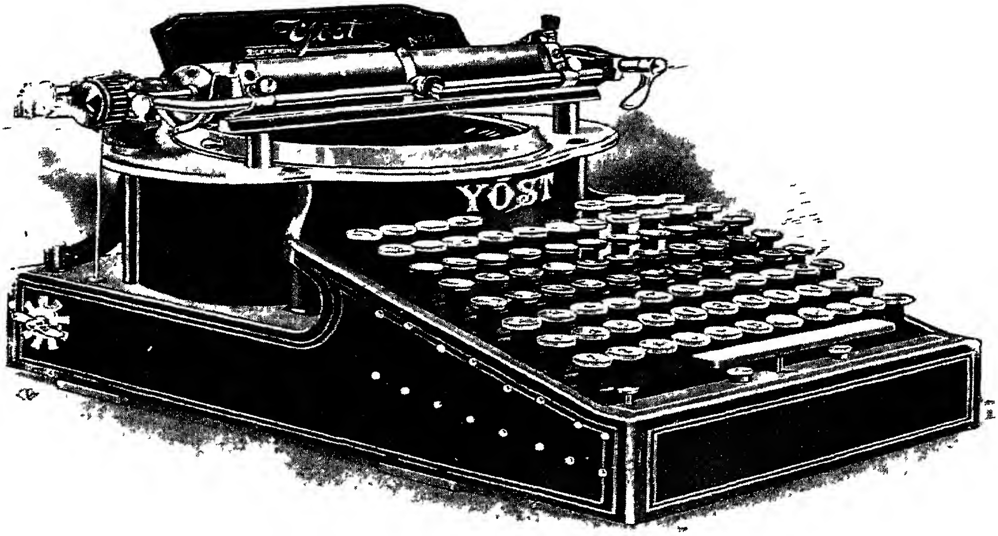


Fig 64

Incidentally, also, an entirely set system of leverage was adopted. As will be seen from Fig. 35, p. 52, the key stems were so made that they swung on fulcrum rods immediately under the key-top. This caused the plate to swing to the operator, thereby pulling the connecting wire. The movement thus imparted was considerably accentuated at the further end, and so the slightest depression possible was sufficient to bring the type to the printing point. An examination of this sectional view with that of the earlier model will reveal the curious fact that, for the first time in the history of the Yost, a slight spiral spring is used to bring the types back to the point of rest, all previous models returning by force of gravity alone. The No. 10 also introduced a novel form of star wheel escapment.

The Yost Company have also introduced machines of special keyboards, adapted to various uses, as well as numerous minor devices calculated to add to the efficiency of their machine under special conditions.

The New Century.

This machine, which was to be regarded as an improved form of Caligraph, was placed upon the market in 1898, and the older form was thereupon withdrawn.

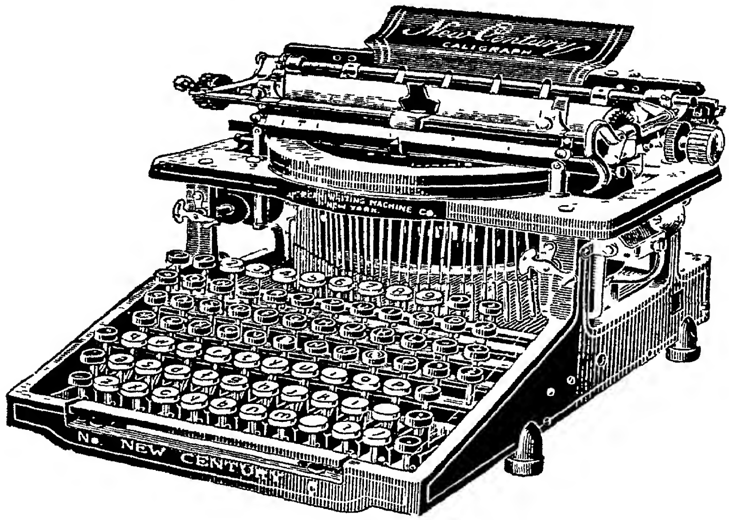


FIG. 65

As will be seen, it presented a totally distinct appearance, being more compact and stately in every way.

The space-bar was placed in front of the keyboard, the latter assumed the standard arrangement, and every regard paid to the convenience of the operators of other machines who might suddenly be called upon to use the New Century.

An improvement of the highest value was made in the system of leverage. It was pointed out that whereas

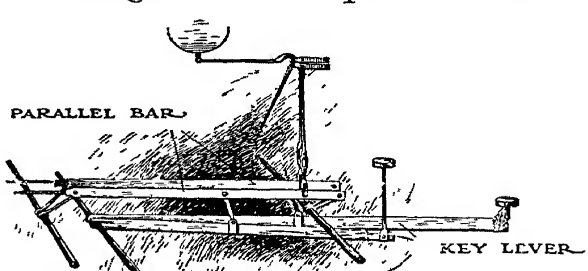


FIG 66

the length of levers varied, a uniform touch was impossible, and to surmount this difficulty a parallel bar, or intermediate lever, was employed, and the levers of each bank

of keys were attached to these bars at points which would secure equal leverage all over the keyboard. The parallel bars were made of steel and attached to the key levers by means of links rotating on rods passing through the machine from side to side. Not only did these bars equalise the touch, but they permitted the alternation of type-bar connections in such a way as to eliminate the risk of collisions.

The type-bars were of steel, formed into proper shape by a drop forging process, which gave superior strength. The pivots were of highly tempered steel. The hangers were **U**-shaped, of best crucible steel, and an adjusting screw passed through the sides for the purpose of taking up any pivottal wear.

Short type-bars are a great desideratum in all machines intended for rapid work. As, however, the large range of characters of the New Century would have increased the size of the type-basket to such an extent as to make the type-bars unwieldy, an extremely ingenious plan was adopted, whereby the hangers were arranged in two superimposed circles. With these short bars, long pivots, direct action, and freedom from jar, permanent alignment was claimed.

The escapement was of the star-wheel variety, and the ribbon automatic in its action.

The carriage was of aluminium silver, and very light in action, running on ball-bearings of novel design. The paper guides were adjustable, feed roll and scales, line-spacing, etc., all followed on standard lines.

For convenience in stencil cutting, means were provided for throwing the ribbon out of commission, thus saving time and soiling of the hands.

Perhaps the most distinctly original device on this machine, however, was one for raising the front rail when a number of carbon copies were made. As is well-known,

FIG. 67

when carbon work is required on machines of this class, the extra thickness of paper will increase the diameter of the platen and the printing point is thereby lowered,

so that the letters from the front portion of the type basket print slightly higher than they should, and those at the back print slightly lower. To obviate this special tracks (consisting of a strip of metal attached to the front rod) have been suggested. The New Century, however, provided a screw for raising the rod itself, so that the alignment could be maintained, irrespective of how many thicknesses of paper were in the machine.

The keyboard extended to eighty-four characters, paper $10\frac{3}{4}$ inches could be fed into the machine, with a writing line of $7\frac{1}{2}$ inches

After a period of six or seven years, however, the machine was withdrawn from the English market, although its advertisements continued to appear in the American journals.

The Smith Premier.

The Smith Premier Typewriter was placed upon the English market about twelve years ago. It immediately assumed a place in the forefront of the " best " machines, where it stands to-day, in spite of the attacks of newer inventions, and the improvements of older ones.

Events which have happened in the world's history have given the Smith Premier a place among the classic instruments of warfare. For it was a Smith Premier that was shut up in Mafeking with Baden-Powell and upon which his famous " Orders of the Day " were produced from time to time. Little did it matter that the Smith was struck by a shell, which knocked the back-gear all to smithereens. Its case was pierced by Mauser bullets until it resembled a sieve more than a typewriter case. Mishaps like these were soon overcome, and the machine was not invalided home when the relief of Mafeking was effected, but, on the contrary, it took part in the long and arduous campaign which followed. It travelled over the " illimitable veldt," as Mr. Chamberlain would say ; it found itself in Rustenberg Gaol, where it was deposited for safe keeping ; and, indeed, as a writer recently stated, the Smith Premier came out of the Boer War with a far better reputation than many a noted general did. Its work, as it was performed from day to day during that wearisome siege, was afterward got together, and reproduced in facsimile by the Smith Premier Typewriter Co., and is to-day one of the most interesting relics of that trying and anxious time.

Even prior to the Boer War, the Smith took part in the battles of its native country. One of the machines

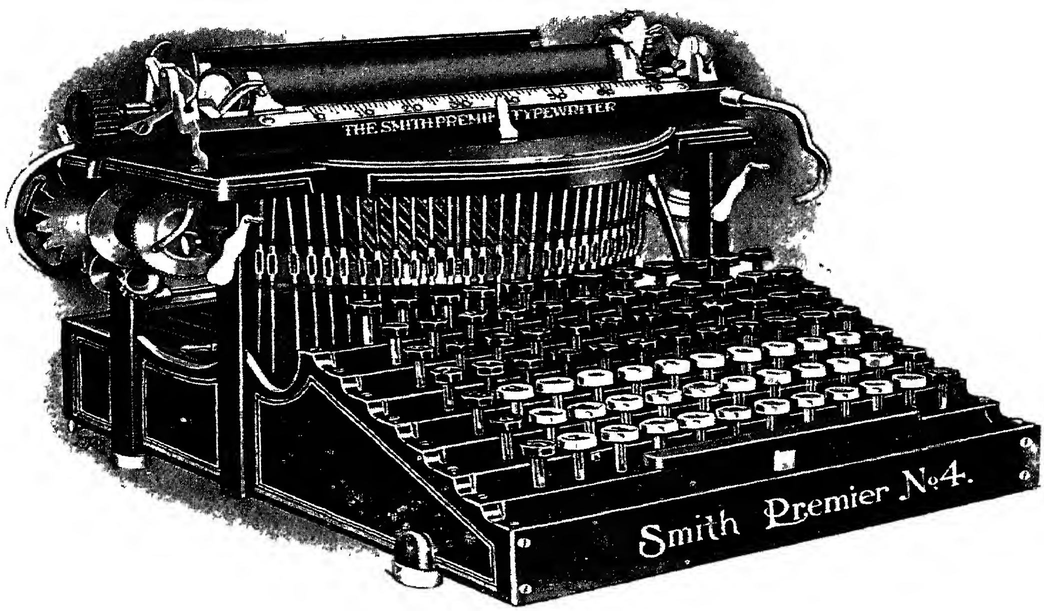


Fig 68

was aboard the ill-fated *Maine*, when the luckless vessel was blown up in Havana harbour. It lay in the water for a week, and was then fished up, little the worse for its ducking, and is now among the most valued possessions of its makers—to be gazed at by future generations of young Americans, who, no doubt, will express gratitude at being the offspring of the country that gave them George Washington and the Smith Premier.

The Smith Premier was invented by Alexander T. Brown, who is now the vice-president of the manufacturing company. The object of the inventor was to produce a good machine. With him, the "curse of cheapness" carried no weight. Moreover, he recognised that the vast majority of machines were used in offices, and that once placed in position, they were rarely moved. Hence portability, whilst not overlooked, was a secondary consideration. Strength and solidity, with the power to withstand the rattle and tear of long-continued usage, appealed more to him than sentimental ideals.

He followed standard lines, too, so far as outward appearances go, but improved the method of carrying out his aims in every point.

For instance, there is not, in the Smith Premier, anything which may be properly described as a key lever. The illustration on page 85 will render this point clear.

On the depression of the key, the stem forces downward a small lug, which is attached to a metal rod. This causes the rod to revolve slightly, and in so doing the lug at the farther end pulls down the connecting wire, and forces the type up against the paper. What could be simpler than this ? But see what brilliant results it affords. Wear and tear are reduced to the lowest minimum. Every rod has the same length, and therefore requires precisely the same amount of force. Pressure being in all cases equal, the speed of each will be the same. There is an evenness and delicacy of touch in the Smith Premier, which calls up the admiration of all who handle it, and which quickly begets a feeling of affection for the machine.

Then the type-circle is small, for the type-bars are the shortest of any double case machine. The type-bars being shorter, they have naturally less distance to travel, hence speed necessarily follows.

But if the type-bar be short, the bearings are long. The view of the machine will show these long bearings. The result of having them is, that the alignment is preserved. Colliding bars will not slacken the screws, nor force the yoke round in any way. Hence, in addition, as we have seen, to the Smith Premier securing lightness and evenness of touch, and strength and stability, as well as speed, the construction of it is such as to guard against the possibility of debased alignment. Once the alignment is set on a Smith Premier, it can hardly ever go wrong, saving only after long and continual use, and then this can be easily rectified by tightening up the screws.

The Smith Premier typewriter is also a capital machine for stencil-cutting purposes. The firm blow, short type-bars, and open nature of the type, render it a king among machines for this purpose. The stability to which we have before referred, also permits of a considerable number of copies, being made at one operation. To do this, it is recommended that the usual platen be removed, and another harder one inserted in its place. This harder platen is ground a trifle smaller than the soft platen, and so permits the several thicknesses of paper to lie in exactly the same position as a single sheet would be, were it round a softer and wider one.

When once the ribbon is placed on a Smith Premier, it needs no attention. It has a lateral, as well as a progressive movement. Thus every fragment of ribbon is

used, and every vestige of colour taken up, before the ribbon need be discarded. It reverses itself automatically. The ribbon requires no pinning to fix it, a patent spool rendering this otherwise dirty operation unnecessary.

Even the cleaning of the type has not escaped the eagle eye of the inventor. Inserted inside the machine and forming part of it, is a circular brush. A long crank can be inserted into the brush in a moment, and a few turns of this, and the type is cleaned. Compare this operation with the wearisome lifting up of type, one by one, so necessary to some other machines.

The Smith Premier has a carriage, certainly, but it is not a carriage such as is generally understood by this

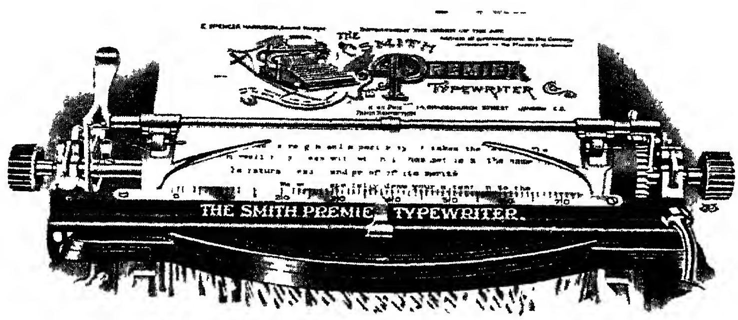


Fig 69

term On the contrary, it might perhaps be more accurately described as a travelling framework, passing across the top of the machine, and carrying the platen. The platen it is that lifts, or rather tilts, in order to bring the writing in sight. This movement is effected with the slightest possible effort, and when carried out, the paper with the writing upon it is brought right in view of the operator. The written line is then just above the scale, and the location of any error, or missed letter, at once ascertained. We have said "the" scale, for owing to the simple nature of the carriage and platen tilting, only one scale is required. Instead of bringing a scale to the writing, the writing is brought to the scale.

The margin stops on the Smith Premier are as perfect as such devices can readily be. When set, they are set. There is no rebound, and they cannot slip. Should it be desired to write outside the margins, either to the right or left, it is easy to do so, and on the next line, when the set margins are again used, they recover themselves automatically.

The platen can be lifted out of the machine by merely raising a couple of catches. It is thus quite easy to clean the machine, or the type, without fear of having a heavy carriage falling on one's fingers.

Improved paper guides are provided which grip the paper firmly as it passes through the machine, and which can also be adjusted so as to hold any width of paper, from an inch wide upwards. The paper needs only to be placed on the paper shelf, and the platen revolved. There is no need to lift the platen or the carriage in order to pass it under the centre guide.

The carriage band, or "strap" is of steel, and indeed, steel seems to be practically the only thing, save the key tops of the platen, employed in the making of the Smith Premier.

As an example of Smith Premier methods, the following incident is worth recording. The Company decided to build a new factory. On the 2nd March, 1903, a site was found. On the 3rd March workmen commenced to dig the foundations.

The president of the Company determined that the factory should be ready in four months. The architects demurred, saying that the finished drawings would take almost as long. "Very well, then," said Mr. President, "very well, then, we'll do without the finished drawings." And so they went to work. They started building in one place, before they had even decided what the length of the building was to be. It was a neck and neck race between the architect and the builder, and the architect just managed to keep one floor ahead of the builder all the time. And the difficulty of building the factory will be all the more clearly understood when we say that it was necessary, in order to bring the material to the place, not only to build a branch railway, but also to build a bridge across the adjacent creek. Four million bricks were put into that building, 2,200 tons of stone, 250 tons of iron, and over a million feet of "lumber." And so the factory was built, and a thousand hands set to work to make the Smith Premier.

The Duplex.

In the desire to obtain the highest possible speed from the typewriter, a great many expedients have been adopted, such as "Speed Escapements," "Automatic Terminal Spacing," etc. The Duplex, however, sought to provide a means of doubling the output of the operator by pro-

viding a duplicate keyboard, so that on any two keys being struck simultaneously they would both print side by side. The mechanism by which this end was attained was remarkably simple. The hangers and type-bars were not arranged in a circle, as in the Remington, but in two perfect semi-circles, the centres of which are separated by a distance equal to the space between two letters of a printed word. All type-bars operating the left-centre were manipulated by the left hand, and those to the right by the right hand. The result was that in one operation either of the following combinations might be struck :—

1. Any capital letter and punctuation mark.
2. Any small letter and punctuation mark.
3. Any two small letters.
4. Any capital and small letter.

It was therefore claimed that the speed power of the operator was doubled, and from the circumstance that the wear of the machine was extended over two alphabets instead of one, the durability of the machine was lengthened accordingly.

The Duplex was well constructed, and incorporated a number of very useful devices. The carriage was very light, and was made to rest on and was guided by a series of hardened steel balls. One of the most interesting of the minor devices was an arrangement by means of which the position of the carriage could be slightly shifted, so that shaded letters for headings, or emphasised words, or ornament, could be easily made.

The ribbon movement of the Duplex is thus described : The ribbon is moved by the carriage tension wheel, feeds across its entire width, and at the same time moves forward two spaces and again feeds across its width ; these movements continue in succession until the ribbon is wound from one spool to the other, when the movement is reversed, so that the entire surface of the ribbon is used in all kinds of writing. It is contended that by this means the ribbon cannot be hammered more at the centre than at the edges, and by reason of the constant movement referred to it cannot be worn more at one place than at another while printing a column of figures or a succession of short lines.

A curious point in the Duplex was the ability to shift the carriage about the fortieth of an inch, so that a line of writing, if rewritten, would appear to be shaded, a very useful point in typing headlines or emphatic words.

The Dennis-Duplex.

This machine was an early form of the Duplex. It was practically identical with the machine, save only that the inking was effected by means of a pad, hidden down in the internal parts of the machine.

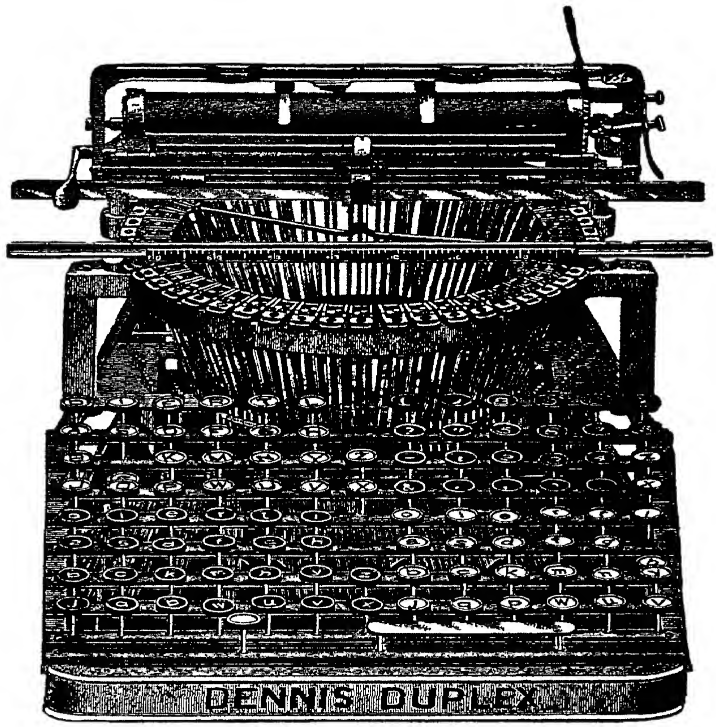


FIG 70

The Jewett.

This machine is provided with a single centre—that is, it printed only one letter at a time. The name was given in honour of Mr. George A. Jewett, the president of the manufacturing company. Several numbers of the machine have been made—one, the No. 10, having no less than ninety-four characters. The general mechanism of the machines was practically the same as in the Duplex. A large number of little contrivances were incorporated into the machine with a view to securing its greater effectiveness. There was a line indicator and pointer, which denoted at a glance the position which would be assumed by the next letter; adjustable paper fingers permitted the use of any sized paper; the margin stops were operated from the front, the margins could be readily released, and the bell always struck five spaces from the

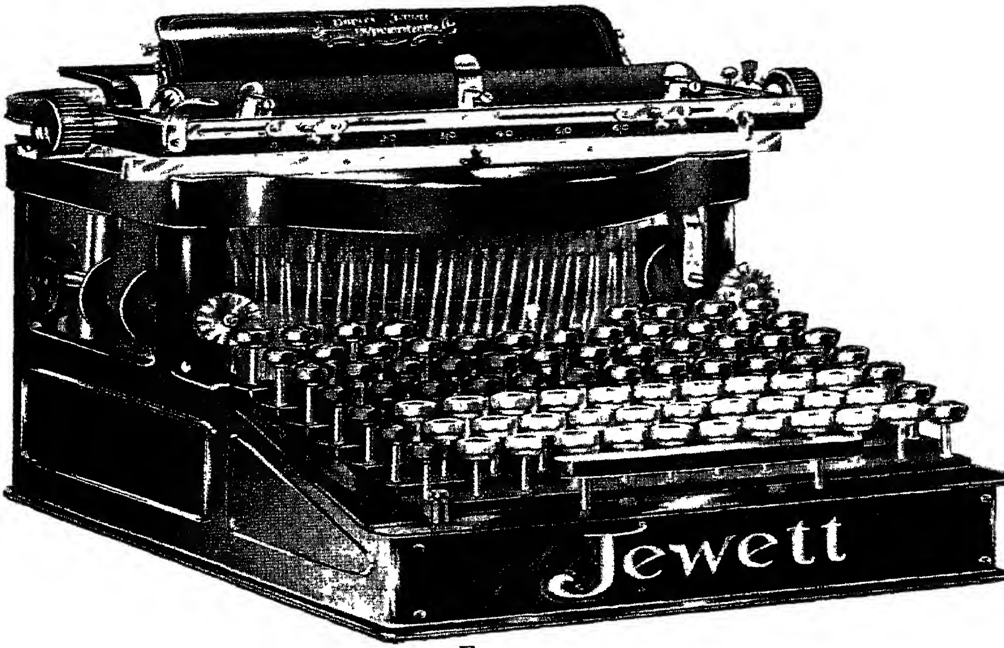


FIG 71

end of the line, wherever that might be arranged for. The following extracts from the catalogue of the Jewett present clearly the argument in favour of a lifting carriage, as opposed to a "work-in-sight" machine :—

"There is but one best way of typewriting. In this, as in everything else, a division of attention forebodes ill results. The operator should watch his notes. This is of first and prime importance. He should not concern himself with the notes one second of time, with the keyboard another, and with the inspection of writing at still another; but should constantly and unceasingly watch his notes. He should see that the first step towards a perfect copy—the translation of his notes—is correctly taken. This practice results in perfect work. Any other method of typewriting produces incorrect, untidy copy, and instead of conducing to rapid and expert operating, retards the speed of the beginner and expert alike. Hence the advantage of a double-alphabet type-bar machine having a light lift-carriage. The typist has but one thing to watch. The writing being concealed, the keyboard being simplified by discarding the clumsy shift device, the notes alone receive whole attention. Instead of correcting errors, he first takes care not to make them. Incidentally, it is worthy of note that the most approved and successful writing-machines have followed this prin-

ciple of construction, which is, and promises to be for a long time, sanctioned by the largest and most discerning users of typewriters."

That is one side of the question ; the other side we shall see in our second division.

The Hartford Typewriter.

This machine, named after the place of its manufacture, the City of Hartford, in the state of Connecticut, U.S.A., came on the English market at an opportune moment, and for a while, seemed to have a very prosperous career before it.

The machine was the invention of Mr. John M. Fairfield, who became president of the manufacturing company This gentleman had been associated with the Caligraph, and was therefore no stranger to the requirements of operators. His own idea, when starting to work on the preparation of a machine, was to produce one which would show increased efficiency, at a decreased price. After preliminary announcements, orders were first placed on file in March, 1895, and the company ceased operations in 1902, having just passed its seventh year.

The keyboard was arranged in the Universal order, but the writing line was limited to seventy characters, which experience has shown is not long enough for English requirements, although the carriage would receive paper nearly two inches wider.

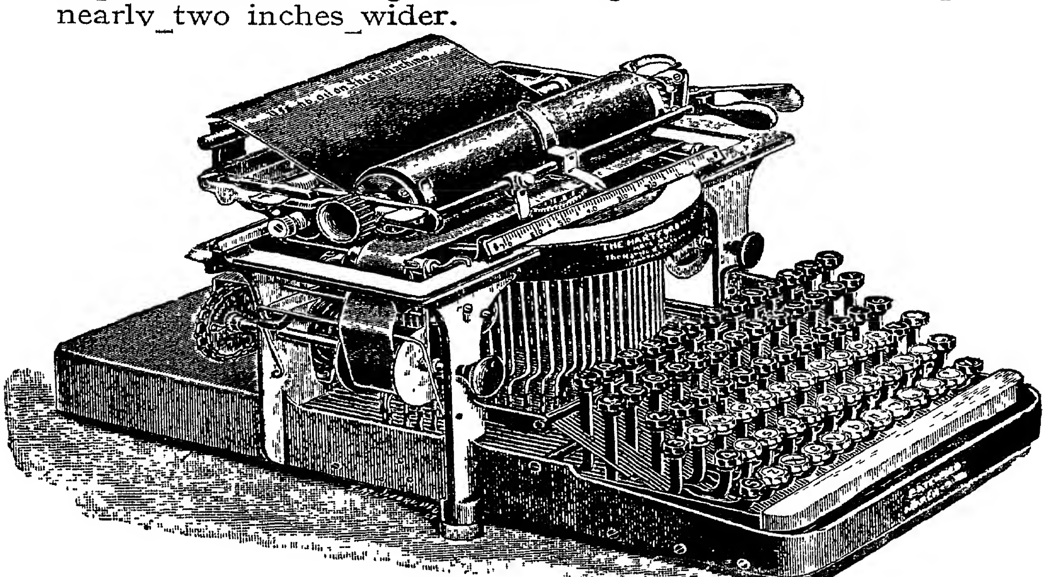


FIG. 72

The most essential feature of the machine was a large comb, made of brass, which passed right round the type-basket of the machine, and which served as a guide to the type-bar in its journey to the printing point. True alignment was thus said to be preserved. The same idea had been incorporated in the International machine, already described, and was a development of the peculiar form of type-bar hanger adopted in the Sholes-Glidden typewriter. Theoretically, this comb was all that could be desired, but after some amount of practice, the type-bars would be found to wear the sides of the comb, and the true alignment was thus thrown out. The roughening of the comb also caused stickiness, which the slightest speck of dust accentuated, and the machine became very slow of operation.

In other respects, the Hartford was a good machine. It had a lateral ribbon feed, and an automatic reverse, which worked with unfailing accuracy. The platen did not swing, as in the Smith Premier, nor did the carriage lift, as in the Remington, but there was a little contrivance, which, if depressed, caused the platen to rise automatically. Only two degrees of line spacing were provided for.

There was a pointer, which served to indicate where the next letter would print, as well as show the position of the foot of such letter. One could therefore use ruled paper with unfailing accuracy. Means were provided for lessening the pressure on the feed roll, in order to permit of the insertion of a large number of sheets for carbon work. The types were concave, and were cut very deeply, so that the machine could be used for a considerable time before the type required cleaning. It was a very good stencil cutter, and did magnificent carbon work.

The materials used in the manufacture of the Hartford were in every respect equal to those employed in more expensive instruments, and a little book of certificates to this effect is issued. The instrument was very big and heavy, but apart from this, and the wear of the comb, there seemed to be no radical defect in it.

When the Hartford was first put upon the market, the price at which it was offered was fixed at ten guineas. This sum was speedily raised to twelve guineas, and after a year or so, another rise took place to fifteen guineas, but if the machine were purchased on instalments, the price was to be twenty-one pounds, because, as the catalogue quaintly put it, "that is the proper price!" and finally it dropped again to twelve guineas.

Before closing the account of this machine, it should be mentioned that the marginal arrangements consisted of a block threaded on an archimedian screw, which could be put out of commission by a touch, and in later models a similar device was used for the escapement. The accompanying illustration will show how this was used. It was an interesting experiment, and greatly improved the touch of the machine, since it took away the strain which otherwise existed between the dogs and the rack.

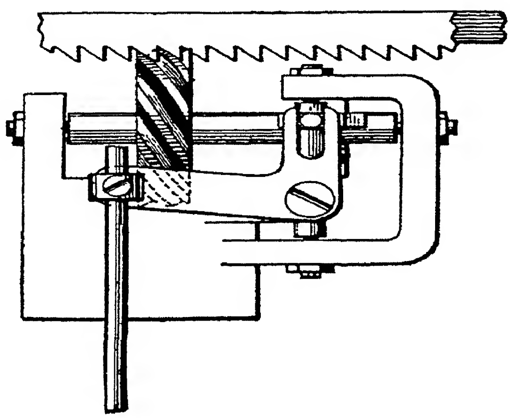


FIG 73

Group III.—Machines with Two Shift-Keys.

The National.

This machine, the invention of Mr. H. H. Unz, prints by means of twenty-seven keys and two shifts—eighty-one characters. The dimensions are 9 × 12 × $7\frac{1}{2}$ ins. high, with a weight of about 13 lbs. The keyboard is semi-circular in shape, and the keys, which are of black compo with white inlaid characters, are placed further apart than usual. It is considered that this leads to greater accuracy, inasmuch as it is almost impossible for the finger-tips to touch and depress two keys simultaneously. The carriage is very light, and will travel when raised, thereby assisting in the correction of errors. There is a guide on the carriage which enables envelopes, postcards, or small paper to be fed into the machine with perfect accuracy and freedom ; and the construction is such that folded papers may be passed into the machine and written upon with perfect ease and regularity.

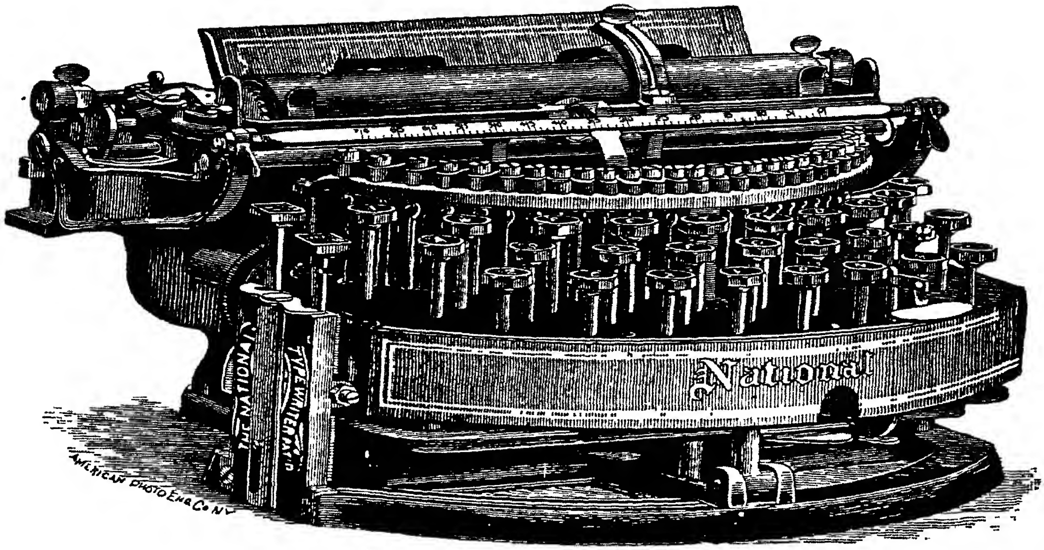


FIG. 74

The finger-key action is very simple. The key-stem is a round wire rod, and is covered with a light spiral spring. At the lower end is riveted a very short lever—in fact, so short that the makers deny having levers at all—and at the other end of the lever is the connecting wire which connects with the yoke end of the type-bar. On depression of any key, the short lever (that is *not* a lever) acts directly on the bar, bringing the type-end into contact with the paper On being released the spiral spring (which is compressed between the key-top and a key-stem plate when the key is down) causes the key to resume its usual position.

The peculiarity of the National is that the depression of the shift-keys does not affect the carriage nor the type-basket, but shifts the whole of the key-board nearer to, or further from, the printing point.

The National is noisy, has a decidedly heavy touch, owing to the shortness or absence of the levers and the weight of the type-bar; is expressly stated to be good for for multi-colour work, owing to the ease with which the ribbons may be changed; is very convenient for carrying, and is sold at a low price.

The Armstrong.

This machine is a very simple little instrument, employing in all only about 325 parts, and although selling at £9 10s. only, is yet capable of doing very good work. The types are mounted on the ends of long wire levers, and strike upwards through slots in a comb to the printing

FIG 75

point, where they enter a type-guide, which thus secures alignment. There are twenty-seven keys working with two shifts, so that eighty-one characters are provided, and the inking is effected by a ribbon.

The type-bar is the great part of the machine, and is well worth examination. Just at the rear of the type button is what is technically called a *saddle*. Inside this saddle is a slight indentation or cup, and this cup fits on a post in the base plate of the machine, being held there by a spiral spring. The result is an entire absence of friction so that a very light touch is sufficient to secure an imprint.

The Armstrong is fitted with marginal stops, but no margin release. The carriage runs on ball bearings, and is geared direct on to the drum of the mainspring, and being centre-driven, there is the same tension at the end of the line as at the commencement. The escapement is a star-wheel arrangement, and is capable of responding with the utmost rapidity. The usual means for sounding the warning bell, reversing the ribbon, etc. are provided. The line spacing is made simultaneously with the return of the carriage, and several carbon copies can be made at one operation. The Armstrong is also a good stencilling machine.

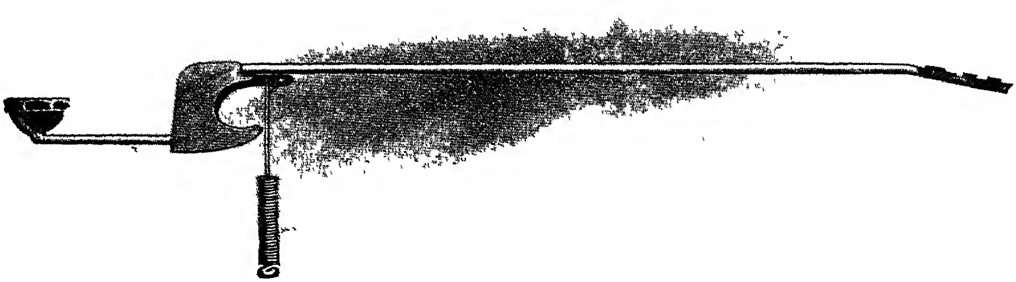


FIG. 76

CHAPTER IV.

Machines with Carriage at Rear.

IN the present section we deal with machines in which the carriage is placed at the rear and the types, which either rest normally in a perpendicular row between the keys and the platen, and strike down on to the top of the latter, or are placed in an horizontal plane and strike the front of the platen, leaving an impression in full sight of the operator.

The first machine to perform its work in this manner—at any rate, so far as the British Isles are concerned—was the Bar-Lock. The conveniences afforded by visible writing are claimed to be many and various. Calculations of an interesting nature have from time to time been made of the total loss of time which arises in the course of a day's work through the operator having to lift the carriage to observe the progress he is making with his work. The result is that it is asserted visible writing will not only add very considerably to the facility with which a given piece of work may be executed, but the fact of each character being in full sight of the typist the moment it is conveyed to paper will enable the operator to perceive and correct any error immediately it is made, and the feeling of security which is thus afforded will also tend to greater speed.

Group I.—Downstroke.

The Bar-Lock.

The Bar-Lock typewriter was the invention of Mr. Charles Spiro, of New York, who, before the machine under notice was placed upon the market, had invented another little instrument called the Columbia, with which we shall deal in due course. The company formed to exploit this machine was called the Columbia Typewriter Manufacturing Company, and when the Bar-Lock was made, it also bore the name of that organization.

The Bar-Lock typewriter differs from those in the foregoing chapter, inasmuch as, instead of arranging the type-bars in a circle, with the types hanging down, the circle was cut in halves, and the type-bars turned up, so as to strike downward towards the paper. The second half of the circle was then placed behind the other, so that the bars struck between those in front row. This permitted the first great aim of the inventor to be secured, namely, visible writing.

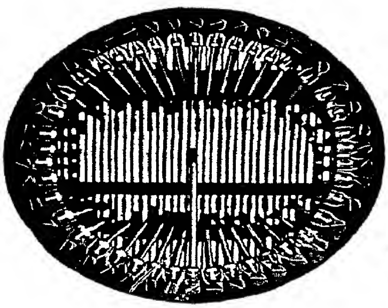


Fig. 77

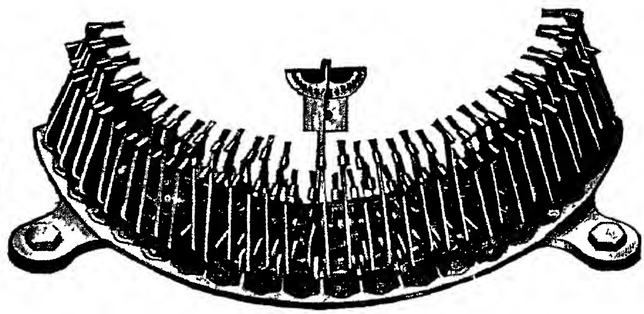


Fig 78

The Bar-Lock was also the first machine to use a duplicate keyboard. The Caligraph, years previously, had provided a key for each character, but the principle governing the arrangement of the characters in that machine was to group the small letters in the centre of the manual, and surround them with the capitals. The result was, that the position of the lower-case characters afforded no clue whatever to the location of the corresponding capitals, and the learner was therefore actually hampered with having to acquire a totally different arrangement. But in the Bar-Lock the three lower rows were assigned to the lower-case, and the next three rows to the upper-case, and all that was necessary to change from one to the other was to slightly raise the position of the hands, and then write in exactly the same manner as if small and not capital letters were required. In order to "render unto Cæsar the things which are Cæsar's" it is desirable to accredit this feature to the Bar-Lock.

Each key of the Bar-Lock, therefore, carried its own meaning. The ribbon, carried on two spools hidden down in the well of the machine, passed over a ribbon-guide, and gradually wound from one spool to another, when the motion was reversed by a touch of a small lever. The ribbon did not, in the earlier models, recede from the paper after the impression, but was quite stationary. Numerous

devices, at present thought to be indispensable, found no place on the earlier Bar-Lock, the keyboard of which was limited and the general conveniences of which were, as regarded in the light of modern days, equally circumscribed.

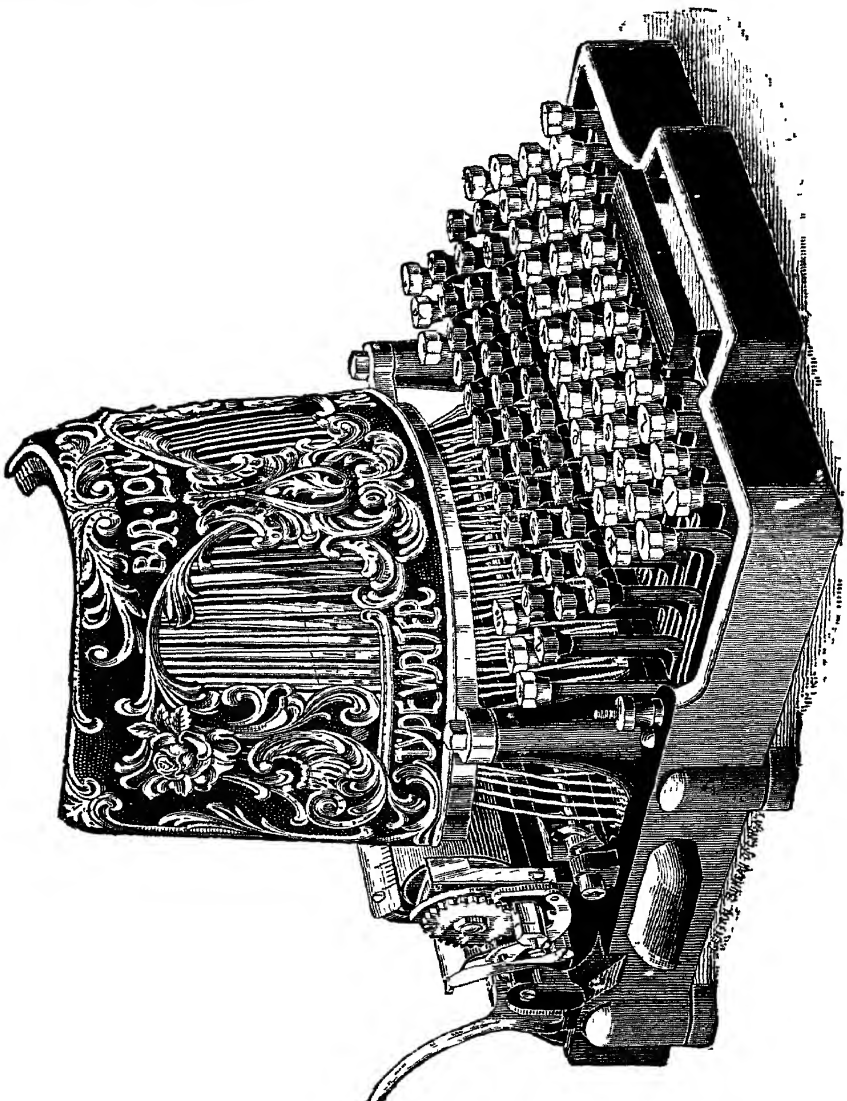


Fig 79

The popularity which the Bar-Lock soon attained naturally led its energetic sponsors, who were then styled W. J. Richardson & Co., to convert the business into a company, under the present title of The Typewriter Co., Limited.

The Bar-Lock typewriter takes its name from a series of phosphor-bronze pins which are mounted close to the printing point, and between two of which, every type-bar must pass before it can reach the paper. These pins are so placed that they allow room for the bar to enter, and no more. If two keys are struck simultaneously, then each of the corresponding bars would be forced a little out of its true direction, and the pins would refuse to let either pass. The type-bars are very light, but to gain rigidity

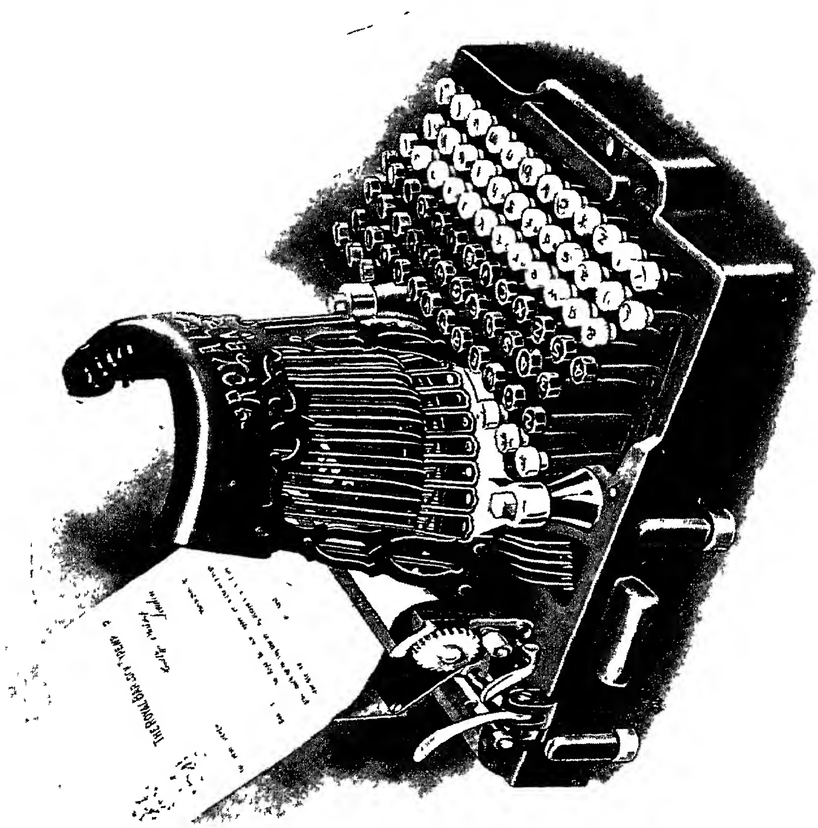


Fig. 80

they are swedged, that is, a rib is embossed in one side, which prevents any bending or twisting, and this advantage is assisted by means of the resilient nature of the steel from which the bars are made.

In the earlier models of the Bar-Lock, each type-bar was mounted in its own hanger, the latter being screwed to the top plate. Later improvements, however, showed a means of rigidly mounting three bars in each hanger, so that the latter could be made exceedingly strong and firm, and so secured lasting alignment, independently of the locking pins. It would probably serve no good end to trace the machine through all its various developments, but from the first the great aim of those responsible for it has been to leave nothing for the operator to perform manually which could be performed mechanically. The following points are claimed as having originated with the Bar-Lock and since have been adopted by many of its rivals :—

1. *Automatic ribbon reverse.*—When the ribbon has passed from one spool to another it reverses its direction automatically, and requires no care or trouble from the time it is put on the machine until it is taken off, worn out or exhausted.

2. *Automatic platen reverse.*—There is no need to touch anything, fasten or unfasten anything, in order to reverse the platen. It is free to move backward or forward as desired.

3. *Left-hand margin release.*—When the margin is set, and it is desired to write outside the margin, there is no need to remove a peg or unturn a screw, or anything. Just touch the margin release key, and the margin is gone, but it automatically recovers itself when the next line is written.

4. *Automatic keyboard lock.*—When the full line of writing is reached, the keys lock and will not print anything further. There is, therefore, no fear of piling letters up, but—

5. A touch of the margin release key will enable more letters to be written.

6. The platen can be instantly removed.

7. The ribbon can be removed in a moment.

8. The carriage can be released for its immediate shifting from place to place.

9. Wheel for rapidly rotating the platen.

The feed of the Bar-Lock is, as far as is humanly possible, perfect. Thus, if a sheet of paper be in the machine it is not necessary to remove it in order to write an envelope or a postcard. The latter is fed in on top of the former, written, and the first piece of work brought back into perfect line, and proceeded with as though there had been no interruption.

After the Bar-lock had been on the market a number of years, the makers introduced a variation of the machine in which a shift-key was introduced, the object being to provide for the requirements of those who had been used to shift-key machines, and who, although preferring to see the work as it proceeded did not want to learn the duplicate key-board.

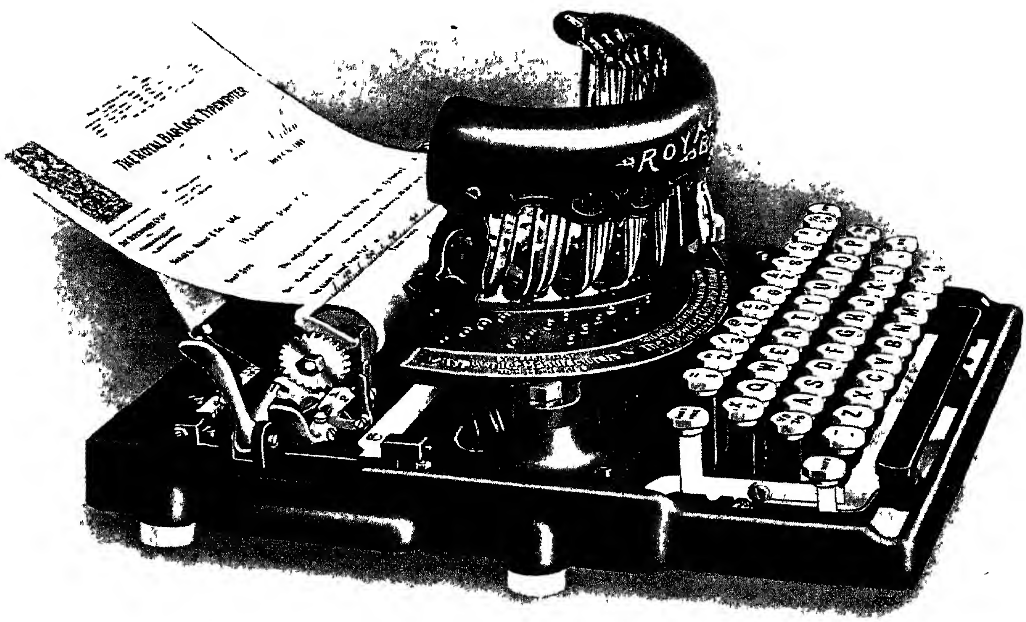


FIG 81

The Salter.

The Salter is made by Geo. Salter & Co., the spring balance manufacturers of West Bromwich, whose name is familiar to the public as the makers of penny-in-the-slot weighing and other automatic machines, which find so prominent a place in our railway stations, and whose other productions are used throughout the habitable globe.

It was in 1896 that the Salter machine was first placed on the market. The early model possessed a number of novel features, and a very good idea of its appearance may be gathered from the illustration. It will be seen that it had a semi-circular key-board, which was considered at that time to be easier of manipulation, as it preserved the natural position of the fingers. The machine also poss-

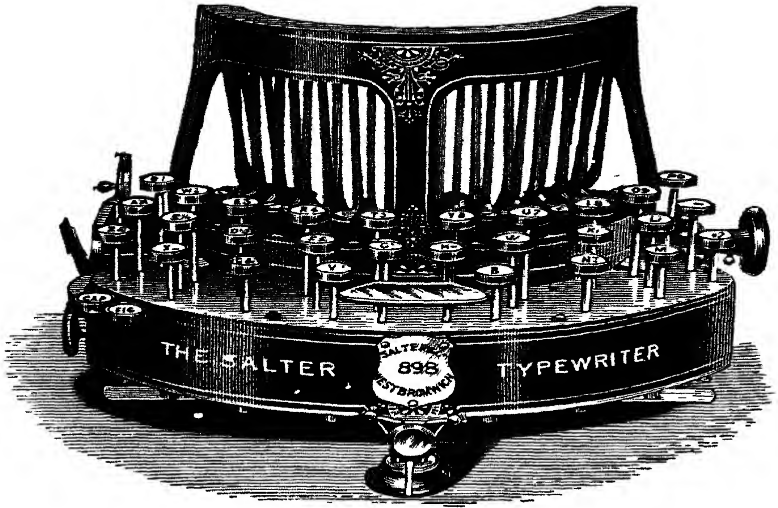


FIG. 82

essed visible writing, and many other advantages of a more or less important nature.

The sale of the Salter was entrusted to a syndicate, and improvements were added from time to time (among them being a square key-board which appeared to be preferred by the majority of typists), and in 1903 the makers decided to conduct the selling as well as the manufacturing part of the business.

The Salter machine has been so vastly changed in its later models that there is no comparison between the present instrument and the previous models.

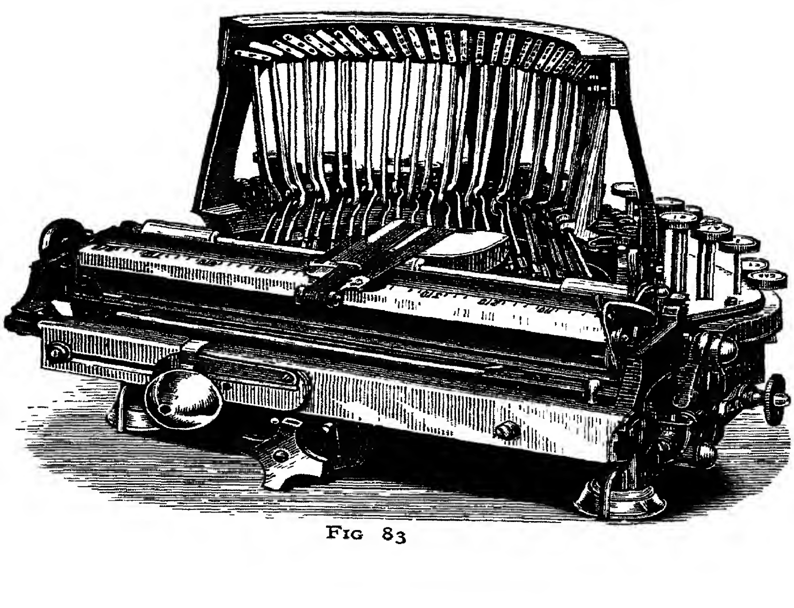


FIG 83

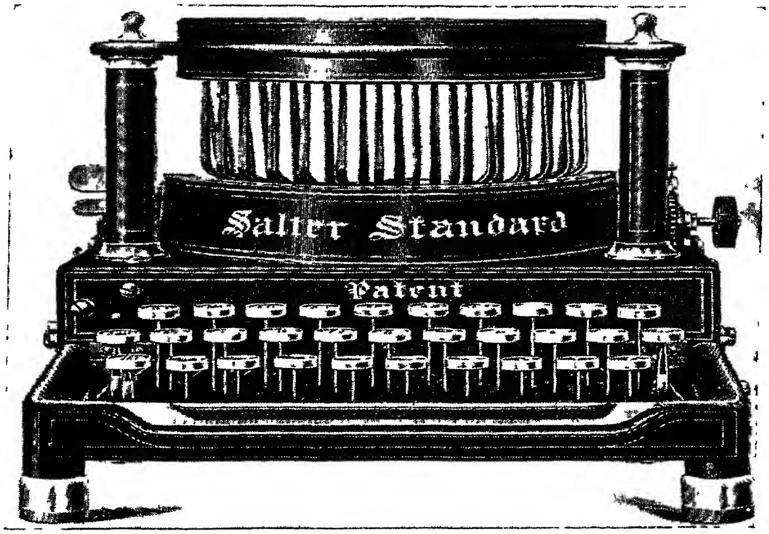


FIG. 84

The Salter has also visible writing. The types are made of the finest steel, and claims perfect and permanent alignment by means of the rigid bearing. The ribbon movement

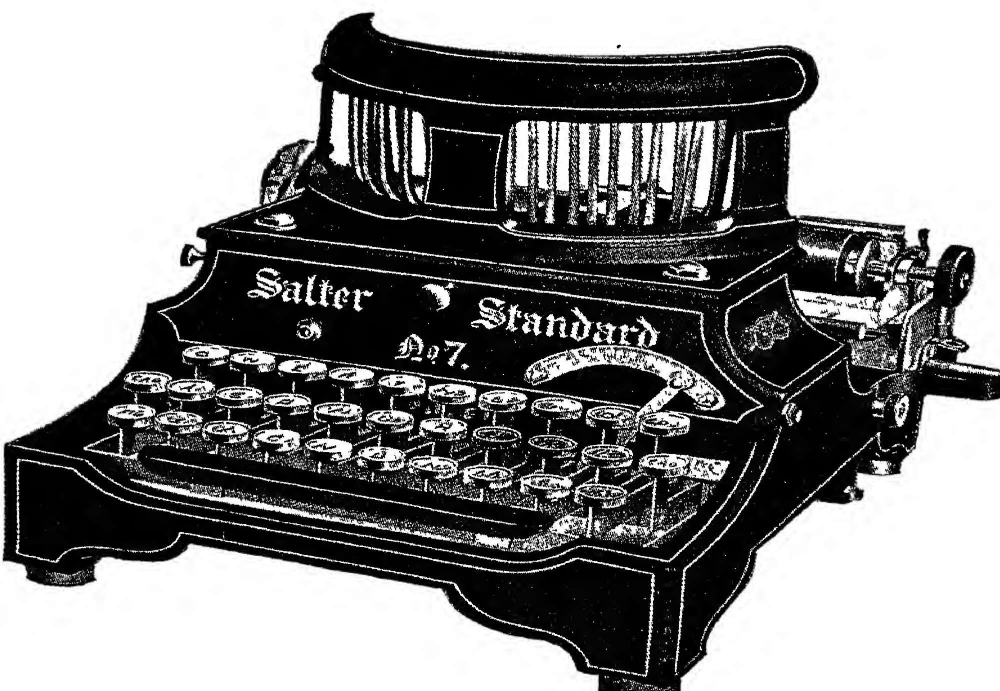


FIG. 85

is quite automatic, and the touch of the machine, whilst probably as light and responsive as any on the market, differs considerably from all others.

The greatest care has been and is exercised in the selection of the manufacturing staff; almost every part of the country has supplied its finest mechanics, which, combined with the most up-to-date machinery, enables each section of the machine to be constructed with the thoroughness and exactness so essential to a typewriter, and which is only to be obtained by the utilization of skilled workmanship.

The keyboard is of the standard type, having twenty-eight keys, which give, with two shift-keys, eighty-four characters, including upper and lower case letters, figures, punctuation marks, commercial signs, and if required, special accents to enable the operator to write in French, German, Spanish, Swedish and many other languages.

Ball bearings, which give such rapidity of movement to all travelling parts, and such durability where there is any likelihood of friction, are introduced into the carriage-track. The escapement, the most vital part of a machine, is marvellously sensitive and active, the speed of the machine being only limited by the capabilities of the operator. The type-bars, which, of course, receive the shock of rapid manipulation, are made of the finest steel, and are of the girder pattern, which has been found to give the most satisfactory results.

One of the most important parts of the Salter is its manifolding and stencil cutting capabilities, which must commend it to all who desire to utilize such powers, and it is claimed that no typewriter on the English market to-day can supersede it in this class of work.

The English.

This typewriter was, we believe, the first type-bar machine of English invention that was placed on the market. It was the joint invention of Messrs. Hearne & Donne, the former being the original patentee and inventor, the latter gentleman being the manufacturing manager and experimentalist-in-chief to the company which was formed to place the machine on the market. As will be seen from the illustration, it bore a certain resemblance to the "Bar-Lock," and also by its curves and circular keyboard to the Ideal "Hammond," but it differed from both most widely in detail. The keyboard is the first important point to notice. Twenty-nine keys were arranged in two

semi-circular banks. Each key carried three types, namely, the upper case and lower case letters, and a figure, punctuation mark, or other sign.

The entire width of the keyboard being just twelve inches, the hand had too great a distance to travel to permit of very high speed. The shift-keys were placed towards the centre of the machine, but above the keys, which would render it a little difficult to avoid error unless working very slowly.

The great and essential feature, however, upon which the English was constructed, was the type-bar movement.

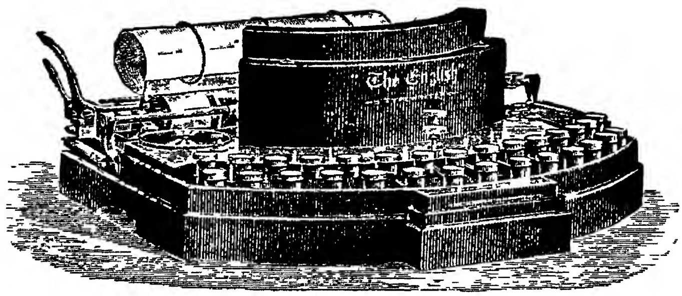


FIG 86

The type-bars hung in a semi-circle on a universal pivot, and were kept perpendicular by their own weight. The lower ends were not connected to the levers, but were curved in such a manner as to cause the bar end of the lever, on rising, to tilt the bar, and so bring the type on to the paper.

The paper-carriage was, as will be seen by the illustration, at the rear of the machine. A circular universal bar placed under the levers controlled its movement. The depression of the bar had the effect of actuating a ratchet, which rose and fell between two dogs or clutches attached to the carriage frame. This ratchet had an upper and lower set of teeth so arranged that, on the depression of a key, the lower rack fell on the under dog, and when the upper dog was left free, the carriage travelled half the distance of a letter space, and on the return of the universal bar after pressure had been removed, the rack rose clear of the under dog, and completed its movement. On the left of the machine will be noticed a circular drum. In this was coiled the spring, from which was derived the motive power actuating the carriage. A number of minor conveniences were incorporated, and finally the machine was sent out to face all comers. It is unfortunate that greater success did not attend it.

Some little time after it was placed on the market, an announcement appeared that a new model was shortly to appear This new model was to incorporate a number of radical improvements on the first model, but shortly after this a winding-up order was made against the Company on a debenture holder's petition. An attempt was made to reconstruct the Company, but proved wholly unsuccessful.

The price at which the English was to be sold was £18. Its claim to be the simplest bar and key machine so far devised, was undoubtedly well founded, as the whole of the working parts had been reduced to the lowest possible number, the eighty-eight characters printed by the machine being produced by fifty-eight parts, having only eighty-seven friction points. There were, as mentioned, no springs or connecting rods to actuate the levers. In this, perhaps, were the seeds of its death. In order to keep up an automatic action in a machine, it is essential that every trace of dust should be kept out of the machine. In the present case, the merest speck would be sufficient to produce sluggishness of the movement of the type-bar, and the result would be double printings, colliding bars, and mutilated types. Specimens of the English are to be met with very cheaply, and all interested in the writing machine should examine the structure of this machine closely.

The Franklin.

The Franklin machine was placed on the English market some years back, and, after a time, North's Typewriter Co. made a great effort to popularize the machine. Since North's closed down, the machine has not been prominently before the English public.

It will be at once noticed, that the keyboard of the Franklin is semi-circular in shape. The keys are arranged in three banks, the outer keys to the extreme right and left being allotted to the figures and signs, thus preserving the centre of the keyboard for the upper and lower case letters, which are arranged pursuant to the order observed in the standard arrangement. The space-key is in the centre of the keyboard, and the upper case shift-key is duplicated, one being placed either side of the spacer. The capital shift, however, is not quite the same as in other machines, and it is in this point that the first great departure from established principles as existing at the time the Franklin was first submitted comes in. It is, of course, frequently necessary that only a single upper case letter is required. Then the shift-key marked "Upper case

and return" is depressed and immediately the key is released, and carriage resumes its normal position.

Should it be desired, however, to continue to use capitals, as, for instance, in the case of a heading or address, then the key marked "Upper case and stop" is used, and the carriage remains in position for the capitals to print, until the other shift key is tapped, when the carriage reverts to the proper position for writing lower case. So good is this device, that it has been widely adopted, in various forms, on other machines.

The great feature of the Franklin, however, is the remarkably simple and ingenious type-bar movement. However far the rival inventors of machines have differed

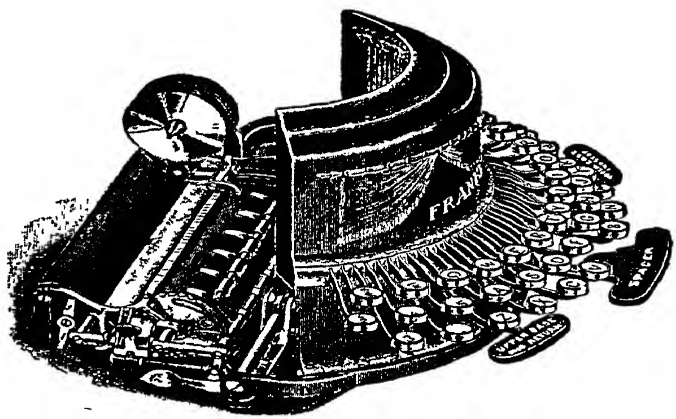


FIG. 87

from a common standpoint, they have invariably aimed at producing as simple a type-bar movement as possible. But certainly no machine has managed to produce so simple a movement as Mr. W. P. Kidder, the inventor of the Franklin.

It may be observed that the type-bar consists of practically only two parts. All wooden and other levers, all connecting wires, turnbuckles, and toggle-joints, together with the train of miseries they sometimes bring, are here discarded, and the whole movement reduced to such a degree of simplicity as to effect a saving of about 400 parts. The direct movement without intervening parts between the type-bar and key-lever gives an action to the keys that produces a touch which is pronounced by some experts to be as positive and satisfactory as that of any typewriter in use.

The simplicity of the carriage secures great rigidity. The type-bars are locked at both ends in the act of printing, and permanency of alignment is thus secured. The type-guide effecting this is placed close to the base of the type-bars, and is also said to take up any wear in the only point of connection between the type-bar and lever. The other guide is placed immediately over the platen at the point of writing contact, an arrangement which prevents more than one type getting close to the paper, and locks colliding types in such a way that neither can print.

The Franklin ribbon is a narrow one, carried on two spools and capable of instant reversal. On the left of the carriage is the line space lever, which on being struck by the forefinger returns the carriage at the same time as it makes the line space. The carriage stop can be adjusted at any point desired on the V shaped track on which the carriage travels.

The bell trip is on the rod holding the spring which operates the upper and lower case, and may be adjusted to ring at pleasure. The usual scales—two in number—are provided, and, as will be readily seen from the illustration, the writing is visible at all times.

An improved model, incorporating a square key-board, was stated (in 1906), to be in preparation.

The Oliver.

Thomas Oliver, the inventor of the machine to which he has given his name, passed his boyhood's days upon a farm, where he found many opportunities for giving vent to his mechanical genius. He made crude models of threshing machines, and reapers and ploughs. Windmills and other mills also found in him a possible improver. These models were made with such tools and material as he found about the farmhouse and the toolshop which was attached thereto. As an instance of his juvenile precocity, it may be mentioned that at the age of twelve, he made up his mind to build a steam engine. He had, at that time, never seen inside an engine shop, but that was no barrier. George Guest, the Indian who reduced the Cherokee language to paper, was absolutely ignorant of reading and writing, and was, moreover, inclined to deafness, but he did his work very well, and Thomas Oliver was not going to be outdone by the Indian, although, perhaps, at that time, he had never heard of him or his work. With the aid of an old hammer and a saw, and a

few other pieces of toolery, he managed to make a steam engine that would not only get up steam, but would actually run. People had great expectations of Thomas Oliver after that, and although years rolled away in the interim, there came in due course a time when his friends' anticipations were filled and fulfilled.

Thomas Oliver, after college days were over, entered the ministry, and, having heard his brother clergy speak of the advantages which a typewriter afforded to the busy pastor, decided that he wanted one, and furthermore that, as he had not one by him, *he would make one*.

There is no need to recount his further efforts, how he considered the various devices which might be adopted, or the numerous points which a typewriter, especially such a perfect instrument as he decided *his* ought to be, should incorporate. After four years' efforts, alternating successes by failures, disappointments with victories, and rebuffs by kindly wishes, he succeeded in producing the first model of his machine, and then, for the first time in his life, he operated a typewriter. For the inventor of the Oliver Typewriter worked no machine until he worked his own! But in that first crude model, Mr. Oliver incorporated ideas and devices which were at once admitted to be most perfect in their conception and application, and which, embodied in a typewriter, were destined to make that machine one of the most popular in the world.

The Oliver Typewriter is a type-bar machine, it works with a double shift, is inked by means of a ribbon, and has visible writing. It is the type-bar, unique in every respect, to which we shall make particular reference.

The type-bar of the Oliver bears some slight resemblance to an inverted U. The two open arms are connected by means of a rod or axle bearing, the type-block is attached to the bow portion of the bar The types strike downward on top of the platen, being made to describe a circular movement by means of the power exerted by the connecting rod on a small projection at the side of the bar. All this is so very simple, that it might almost pass unnoticed in the throng of competing devices, were it not that so many little things have had to be considered that they deserve to be rescued from oblivion.

If we examine the type-bars (for which purpose, if a machine be not at hand, the illustration will serve), it will be noticed that they are of varying sizes, and arranged in two rows and that each bar in each row will pass completely through the next size larger. Moreover, the type-

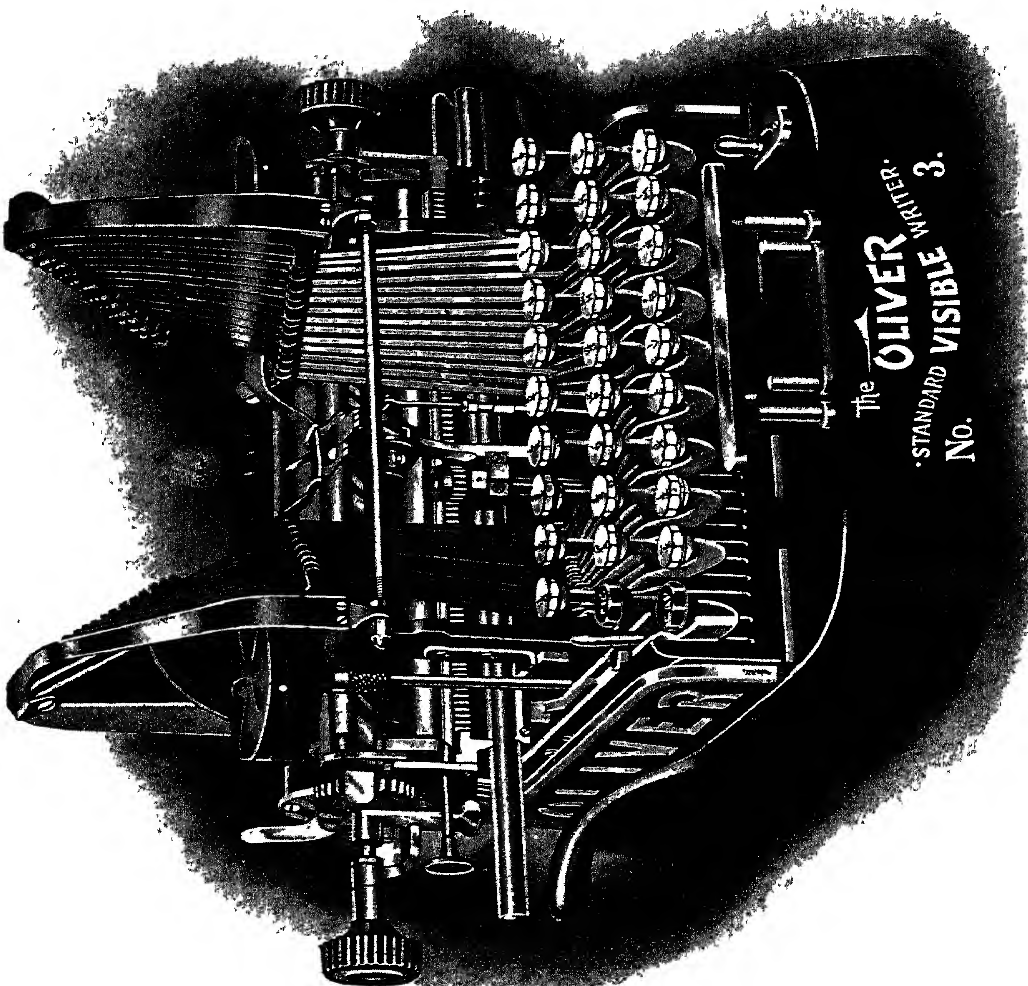


FIG 88

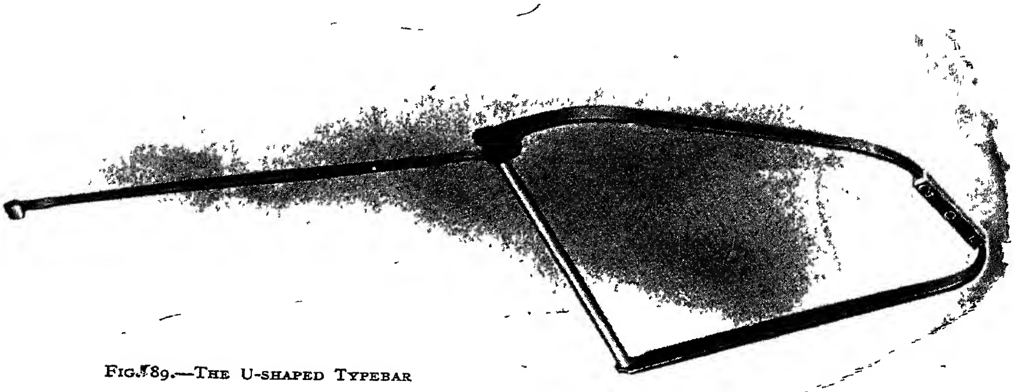


Fig. 89.—The U-shaped Typebar

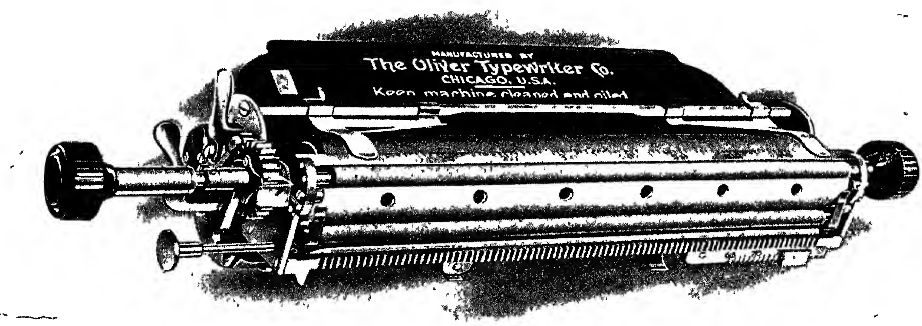
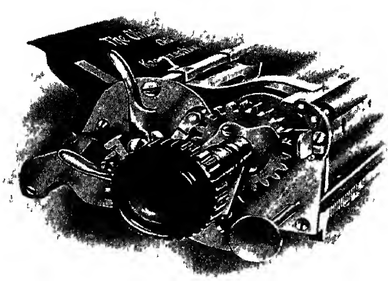


Fig 90.—The Carriage, showing continuous feed rollers



—Left end of carriage, showing release plate, detent indle, etc , whereby operator is given absolute control of carriage at all times

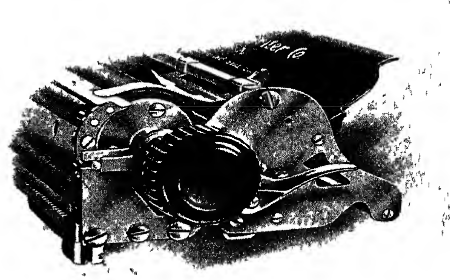


Fig 92.—Right end of carriage, showing feed roll, release lever, right-hand marginal stop, etc.

blocks seem to be out of proportion to the size of the bar, for the larger the bar, the smaller the type-block. Then again, that little projection, or lug, at the side of the bar, also seems to be out of proportion to the block, as the smaller the block, the larger or longer the lug.

The outside bars, that is to say, those bars which are at the right and left extremities of the machine, are larger in size than those immediately adjoining them, and the latter, also, are larger than their next-door neighbours, and so on, and so on, until the innermost bars of all are reached. Now if we imagine a line from the type-block of the inner bars to the printing point, it is quite obvious that this line will not be nearly so long as one from the type-block of the outside bars to the same point would be. As the types have to travel over exactly the same space as those imaginary lines are drawn, it will be seen that the outer bars have to move at a very much higher rate of speed than the inner bars travel at, if they are to get to their destination—the printing point—in the same period of time. The lug at the side of the type-bar acts really as a lever, and the greater the leverage, the greater the speed of the travel of the bar. Inversely, of course, the inner bars have a much less distance to travel, and they therefore move more slowly than the outer bars. To secure this effect, the lugs are shortened, the leverage decreased and the travel impeded. The net result is, that the movements of the inner and outer bars are so accurately balanced that although they move at differing speeds, yet they both take exactly the same time to reach the paper after the key is depressed.

And now with reference to the type-block. As we have seen, the inner blocks are big, and the outer ones small. Now it is well known that a weight, passing rapidly through space, gathers force and momentum as it proceeds. Thus, it has been stated that a farthing, if thrown from the top of St. Paul's Cathedral, would gain such a fearful momentum in its travel that it would probably kill a man in the street were it to strike him. Whether this be true or not, weight certainly does increase in this fashion, and if, therefore, a block of the same size as those on the inner bars were attached to the outer ones, they would gain such additional weight in their journey as to absolutely pierce the paper on the platen, and probably damage the latter also. But the skilful adjustment of weight and distance, leverage and travel, which we see in this bar, is no less wonderful than the shape of the bar itself.

The power of a typewriter in manifolding and stencil cutting, is one of the most important points for consideration when investing. If the success of the Oliver were dependent upon this point alone, then there would be no room for question. It is a most powerful and energetic manifolder. As the types all strike on top of the platen, a score of carbon copies can be taken at once, without the least deviation from the strictly accurate alignment which marks all Oliver work of a single copy. And the fact that most of the Duplicator Companies use the Oliver to demonstrate their own appliances is proof positive of its value in this respect. Particular note should be taken of the fact that each type-block is soldered firmly on to the type-bar, and is not, as in most cases of type-bar machines, *wedged* on to the bar. Thus no type-block can ever become detached and drop off into the machine.

The features of the Oliver are as numerous as the machine itself is noted for its simplicity. It is being worked in this country by an energetic and capable body of men, who, from all accounts, are meeting with the greatest possible success.

It is interesting to note, also, that the Oliver Typewriter Company, Limited, recognising the importance of securing the goodwill of the operator, has founded a body called the Oliver Club, a purely social organization to which operators of all machines are eligible for membership. Arising out of this Club they issue a monthly journal, the *Oliver Magazine*, in which the doings of the club and the latest details concerning the machine are recorded.

The following are the chief characteristics of the four models of the Oliver.

No. 1. The paper feed was original, and peculiar. The swinging of a handle on the left side of the carriage threw the feed roll out, and permitted the paper to be fed in from the lower edge of the sheet. It was very good for envelope and post-card work. The ribbon spools were not covered, and in order to reverse the ribbon, the shaft had to be lifted out of a groove on one side, and the shaft on the other side put back.

No. 2. This introduced the ribbon reverse, and the present form of carriage, together with sundry other useful improvements.

No 3. Introduced the right and left margin release keys, complete paper release, margin guide, etc.

No. 4. Introduced an extended keyboard, covering fractions or other special signs as might be wanted for

literary or linguistic work. It should, however, be noted that the No. 4 Model is a *special* machine and is not an improved No. 3 Model, nor is it intended to take the place of the No. 3. Its keyboard contains ninety-six characters, which is largely in excess of the number on any other standard machines.

The Maskelyne Typewriter.

The present machine, although fitted with a carriage at the rear, and thus falling within the present structural group of machines, yet bears very little resemblance to those instruments which we have already described, since the type-bars neither strike downward, nor do they slide forward. On the contrary, the type-heads lie together, resting in a moist ink-pad, and on a key being struck, the corresponding type-bar is lifted from the pad in an upward direction, then it darts forward, and finally pounces on to the paper as it rests on the platen.

The Maskelyne is the invention of Messrs. J. N. and Neville Maskelyne, of Egyptian Hall fame. It was made in London, and during its effective career was worked by an English company. But from reasons which we shall endeavour to show, it was not accepted by the English public with that enthusiasm which might have been expected, and accordingly, after two or three distinct models had been placed on the market, it passed away.

The aim of the inventors was to secure the greatest possible beauty of work, and it is fairly safe to say that, when the Maskelyne was in perfect order, and the types quite clean, no machine, either before or after, has turned out such beautifully clean cut work.

The Maskelyne worked with a double shift, having thirty-two keys, governing ninety-six signs, a larger number than any other machine then on the market. As stated, it used a pad, so that the ink passed direct on to the paper.

In addition to these points, the great feature of the machine was the fact that it was a differential-spacing machine. This point must be made quite clear to the reader. In ordinary typewritten work, all letters are made to fill the same space, namely, one-tenth of an inch. In Elite machines, there are more than ten spaces to the inch, and in large type instruments, there are only nine or eight, or even less, but whatever the number of spaces may be, each and every letter, whether it be a large W or a full-stop, has just the same space provided for it. Fortunately, the majority of letters in ordinary type have

practically the same width. Thus, a, b, c, d, e, g, h, k, o, p, q, r, s, u, v, x, y, z do not vary very much one from the other. But in the case of f, i, j, l, t, it will be seen that they are only half as wide, whilst m and w are much wider. We have become so used to seeing typewritten work, that nowadays we hardly notice how, in the word

imminent

the m's are crowded together, or how, in the word

illimitable

the i's and l's are spread out. But the Maskelyne machine so contrived matters, that the carriage only moved a narrow space when a narrow letter was typed, a medium space when a middle-width letter was typed, and a wide space for the broader letters. Thus, not only was the proportion of space regulated, but the effect was far more pleasing to the eye. What this regulation of space meant, may be gauged from the following comparison :—

ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABCDEFGHIJKLMNOPQRSTUVWXYZ

From this it will be seen that in the case of the typewritten letters, much less space is required. But compare the following :—

llllllllllll	llllllllllll
nnnnnnnnnnnn	nnnnnnnnnnnn
mmmmmmmmmmmm	mmmmmmmmmmmm

and it will be at once seen what differential spacing was intended to rectify.

In order to secure this end, a very simple, yet effective method was adopted. In place of the one universal bar, as in other machines, the Maskelyne provided four, of which two or more were set in motion according to the width of character printed. The escapement of the machine consisted of a geared wheel, playing direct into the rack at the lower part of the carriage. This wheel was kept in restraint by means of a clutch, which, on the depression of the key was thrown out of engagement, and by means of the universal bars was moved up so many teeth as were required to permit the carriage to travel the necessary distance.

Now, it will be readily understood that the movement of a typewriter is exceedingly rapid, and the machine really has to bear, even with careful operators, a good deal of vibration. To enable it to withstand this, it is necessary that every moving part should be extremely strong, and not liable to twist, shake, or break. The

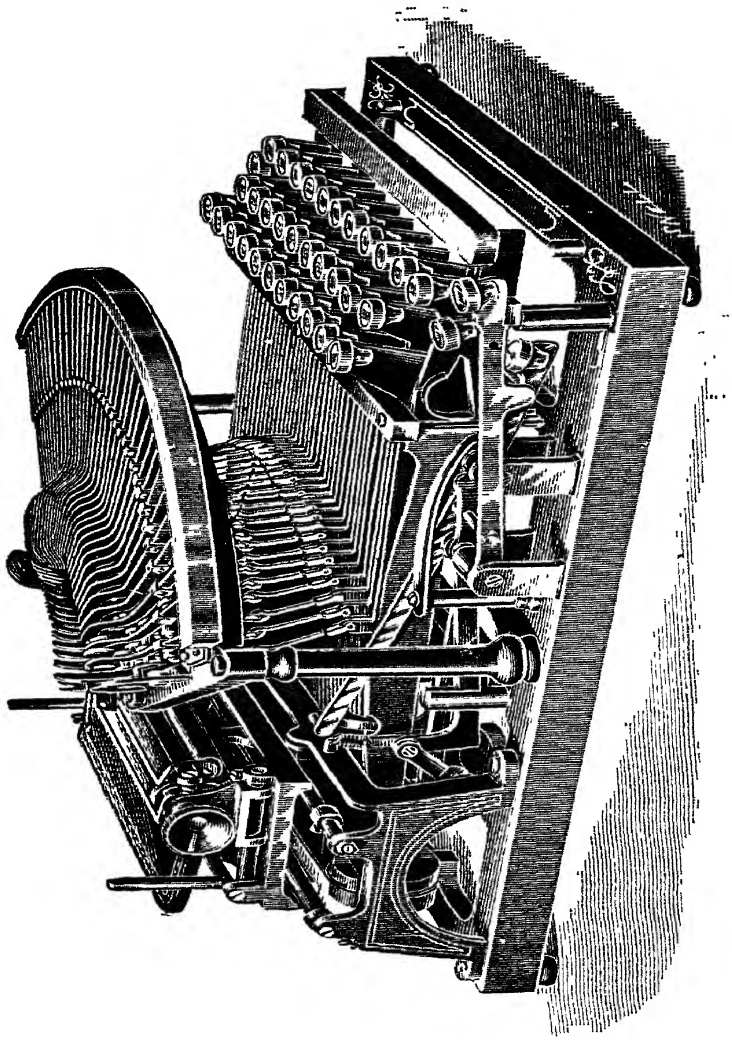


Fig. 93

refinement of parts necessary in the Maskelyne would not permit of their being sufficiently strong, hence after very little use, the machine failed to act. Either the escapement clutch would not move far enough, or it went too far: the various universal bars clashed and other mechanical defects showed themselves. Then, even the most careful operator would make mistakes. To correct these was not an easy task. One could not crowd "w" in the space of "i," and so on. Moreover, the writing of figures in columns was not easy.

We have stated there were four universal bars. Their

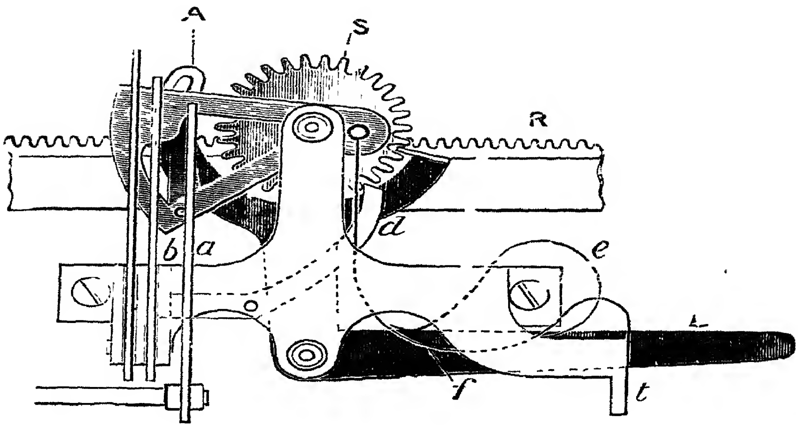


FIG. 94

technical name was spacing-frames. Two, three, or four were used according to the width of character. The use of the other, which permitted the carriage to travel only one half the width of a narrow letter, was in order to type the diphthongs, œ, æ, etc.

The first model of the machine had a peculiar looking grill between the bars of which the type-bars moved. This was subsequently altered to a comb.

In the third or "Victorian" model of the machine, an entirely new form of type-bar was used. The type-faces pointed upward, and rested in a pad, the moist surface of which faced downwards. The bar thus had to turn a complete somersault in order to reach the paper. It was a marvel of mechanism, but very few machines were made, and fewer still sold. The difficulty of differential spacing was so far recognised in this machine that when the figure shift-key was depressed, the figures struck in regular distances, as in other machines.

The Williams.

For convenience, we also include this machine in the present section, and the resemblance it bears to the Maskelyne will be perceived on examining the illustration.

This machine, when first submitted had a slightly curved keyboard, but in a twelvemonth this gave way to the usual square form, which was repeated in the No. 2 machine. The No. 3 was the brief machine, and these two models held their ground for many years.

The No. 1 possessed a double-shift, that is, the keys, when in their normal position, struck all lower case letters. To get capitals, the capital shift-key had to be depressed,

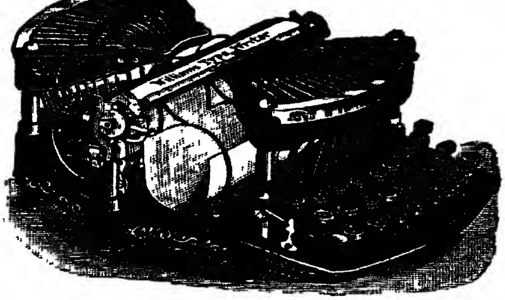


FIG. 95—THE NO. 1 WILLIAMS.

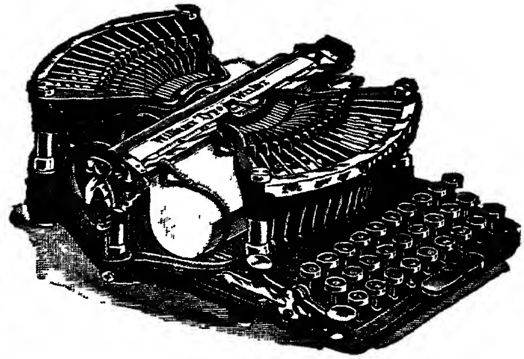


FIG. 96—THE NO 2 WILLIAMS.

and in order to get at the figures, it was necessary to depress the figure shift-key. Nos. 2 and 3 also incorporated the double shift-key principle.

When the No. 4 Williams was launched, which event happened in the year 1899, the figure shift-key was abolished, and the keyboard made to conform to that employed on the majority of typewriters, so that the users of those machines were immediately at home on the new model. The No. 4 also contained a number of other improvements, which have been still further elaborated in the No. 6 machine, which we now propose to describe at length.

The No. 6 was issued in England on the 1st January, 1904. The space-bar is in front of the machine, four rows of keys are ranged behind it, an extremely light-running ball-bearing carriage is mounted in the centre of the machine, upon the platen of which strike the various types, mounted at the end of suitable bars which are arranged in the shape of two fans, one before and the other behind the platen, and all having a common converging centre at the point of impact. The types lie, when at rest, on a saturated ink pad, and are so cunningly arranged, that as a general rule, they strike alternately from the opposing sides, that is to say, if the first character in a word goes forward from the front half of the type-bar circle, the next one comes from the back half, and so on. The effect of this arrangement is to minimise the risk of colliding type-bars, thus assisting in accuracy of work and speed of operation. The writing is absolutely in sight, and, as stated, there being an ink pad, no ribbon comes between the type and the paper.

In the No. 1 and 2 models, the paper was fed into the machine by placing the top edge of the sheet against the small feed roll, to which a slight turn, sufficient to enable

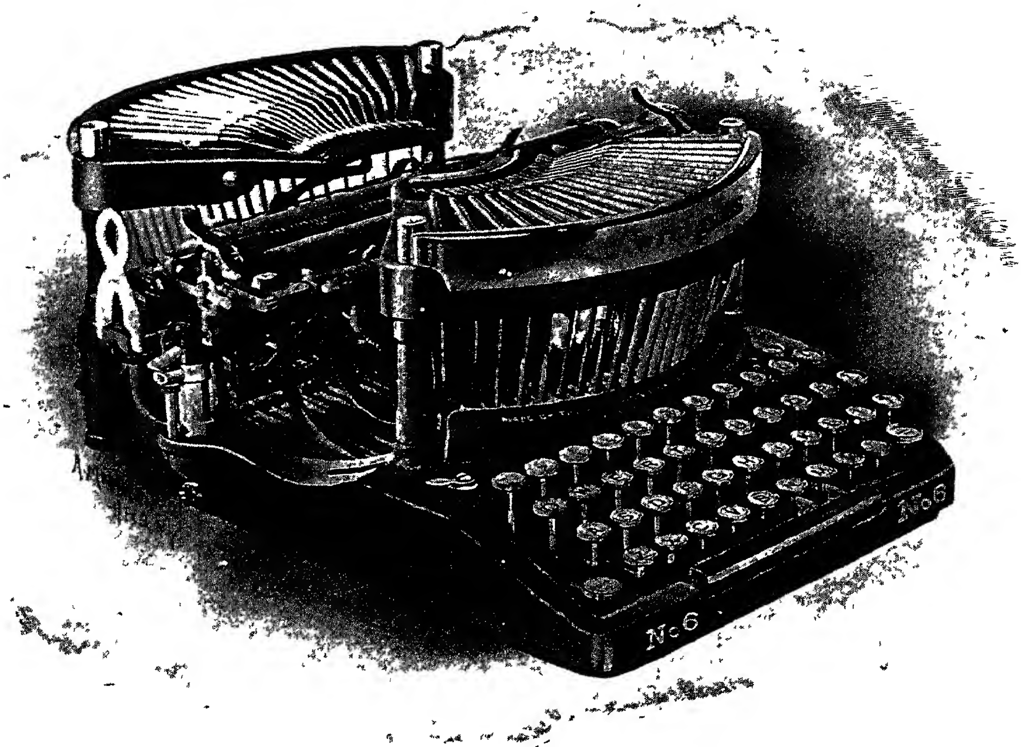


Fig 97

it to grip the paper, was given, the scale-bar was then lifted, and the lower end of the sheet tucked away into the receiver below. This arrangement has now been greatly improved upon, for the paper is placed in the front paper-case feet first and right side up, and the machine automatically feeds it through to the rear case (or receiver) as the writing proceeds. The feed-roll is now placed in front of the platen (thus preventing the risk of smearing from the use of too moist an ink pad), and the whole operation of placing the paper in the machine is performed in a fraction of the time previously required. A sloping paper table carries the sheet as it is fed through after being typed upon, with the result that at least five inches of the work remains absolutely in sight. The paper-case has also been enlarged and perfected, and there is no possible risk of the paper kinking or creasing instead of curling round as it should, under ordinary circumstances, always do.

There is a shift-key at each side of the keyboard, either of which can be used, as may be found more convenient,

and there is also a shift-key lock which can be brought into instant use.

The margin stops are considered to be the most perfect and complete arrangement of the kind to be found on any typewriter. As will be seen on reference to the large illustration of the carriage, which will be seen in Fig. 98, there is a notched scale-bar carrying four margin stops fixed in front of the carriage. These stops may be set at any points decided upon. Should it be desired to go outside these margins, then the small nickel key, just above the top key on the right, acts as a margin release, and throws the stops out of gear, which, however, will be automatically recovered when the next line is written.

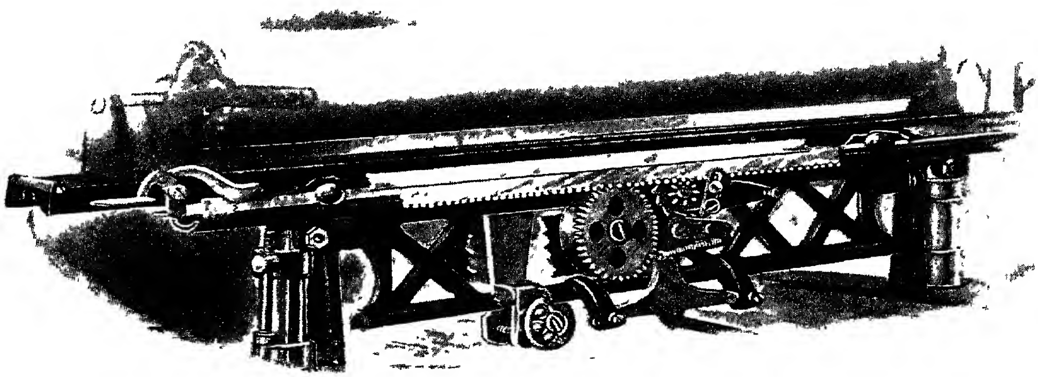


Fig. 98

In the No. 6 Williams the platen can be removed readily and another substituted. If a number of carbon copies are required, the use of a harder platen is recommended, as it presents a less yielding surface and so gives out better copies. The hard platens are ground slightly smaller than the ordinary ones, and the extra thickness of the several sheets of paper thus compensated for, with the result that even under heavy pressure of manifolding, the alignment remains practically unimpaired.

In the earlier models, the type-bar was guided to the printing point by means of openings in a metal comb, which was later changed to a slotted guide plate in which the driving arm worked. It then met the front of the quadrant, and passed between the jaws of a type-guide on its way to the paper There was thus a tendency for the force, when the machine began to get worn a little, to go forward instead of downward, as it should go. To

guard against this, the shape of the type-bar has been so modified that it assumes the direction, and the blow is directed, as is indicated in Fig. 99. This is described in the catalogue as follows:—"In action the shoulder, *E*, strikes the end of the anvil at the same time as the arm strikes the top of the anvil at *A*, thus bringing the type-arm to a solid and unyielding stop, both in its downward and its forward movement. The result is that the type itself is stopped or locked at the printing point in the most immoveable manner, securing unchangeable alignment."

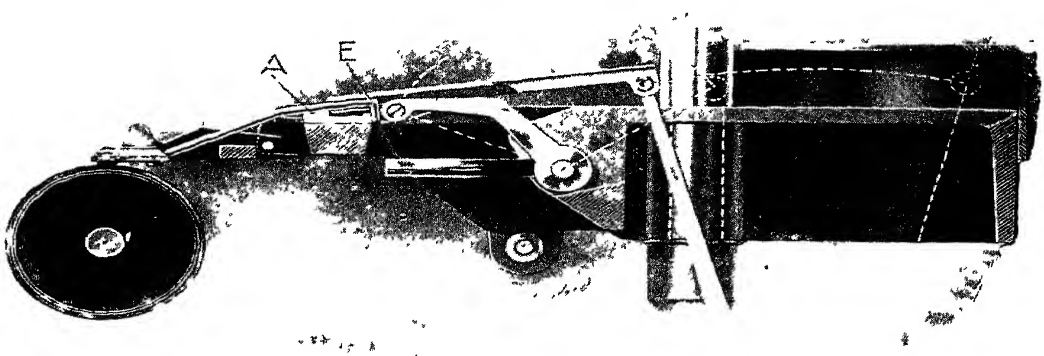


Fig. 99

The slotted plate itself is now done away with, the same effect being secured, only in a far better manner, by means of slots cut in the quadrant casting itself. The machine is thus rendered more solid and lasting than before, whilst, as stated, the effect of the change is to improve the manner of working.

The touch of the No. 6 Williams is pleasant and light. Every key requires exactly the same amount of pressure, and moves just as quickly as the others, there being no slow keys, and no heavy ones. The escapement, which is the most vital spot of a typewriter, has been much strengthened and brought to perfection. There is neither draw-cord, strap or chain to the carriage, the motive power being derived from a spring, coiled up in the circular box shown in the illustration. When this is wound up, there is, of course, a natural tendency for it to release itself, which it would do, save that it is prevented. To effect

this, the teeth of the spring box are geared into the teeth of the rack bar. There is also, similarly situated, another small wheel, which latter is attached to a spur wheel. These spurs engage the dogs, and as the levers are depressed, they cause the universal bar to throw the loose dog out, and so permit of the spur wheel advancing one point. This spur wheel and direct gearing are invaluable in securing rapid and regular work, involving the minimum of strain, adding to the lifetime of the machine and reducing repair bills to a vanishing point.

The Williams is manufactured in America, but the eastern hemisphere is controlled by the Williams Typewriter Company for Europe, a company specially organized for the purpose.

Group 2.—Thrust Machines.

The five machines which follow have the carriage at the rear, but instead of the type-bars striking down to the top of the platen, they are so arranged as to dart forward, striking the platen at the front side. They are thus termed "thrust machines." Only one member of the group has attained any large proportion of success, namely, the Empire. This instrument is undoubtedly the best of its class, and the large amount of Government patronage which it has been accorded fully demonstrates the entire practicability of the instrument.

The Rapid.

In 1890 there was placed on the American market a machine bearing the above name. It was the invention of Mr. Bernard Granville, and was manufactured at Dayton, Ohio, and claimed to possess a number of excellencies not to be met with in other machines.

The keyboard extended to forty-five characters, the Rapid writing only capital letters and the necessary figures, and other signs. The characters were engraved

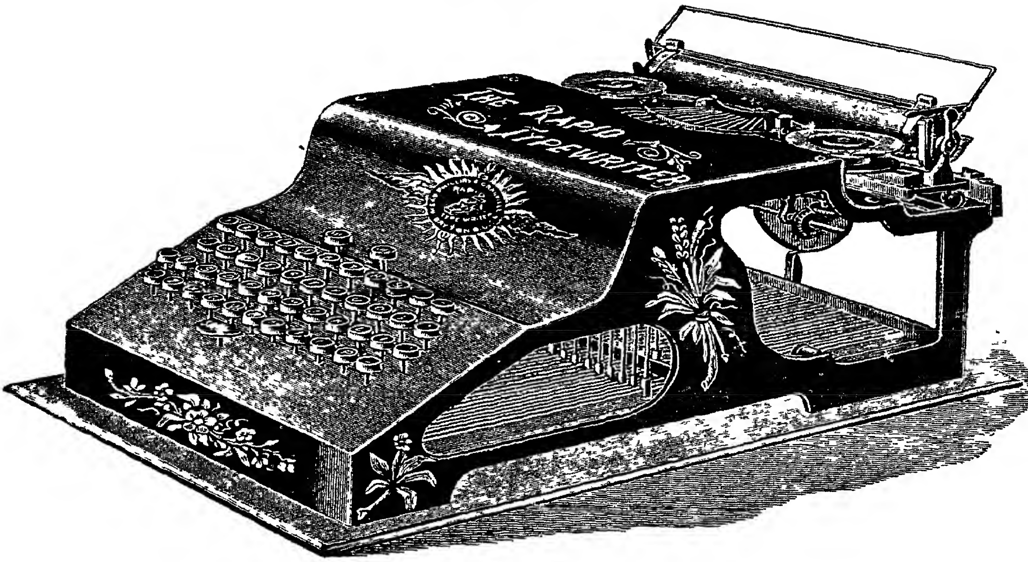


FIG. 100

at the ends of a series of rods each converging to the printing point, and struck forward by means of a direct thrust on to the paper, which was met at the front of the platen. In order to secure alignment, each bar travelled through its own apertures in two guide plates, and struck the common centre against a narrow ribbon. There were provided devices for the automatic return of the carriage and for the line space to be effected, but these did not operate with any degree of certainty.

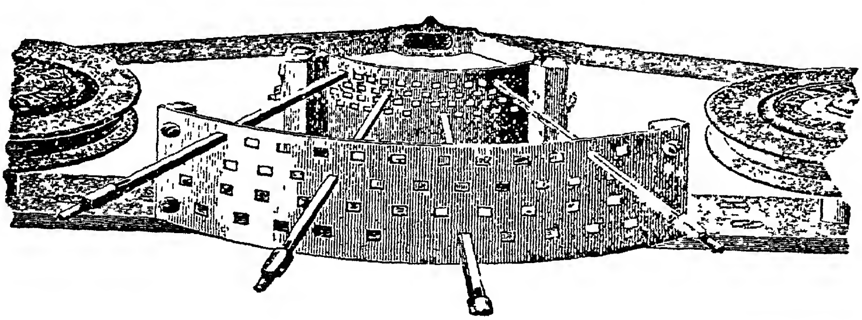


FIG. 101

Shortly after its introduction in the States, an effort was made to float a Company in England to run the Rapid. A capital of £100,000 was asked for, and of this sum it was stated that £75,000 was to be paid to the vendor to the Company for the patent rights. The proposed Company, however, did not meet with the success

that was anticipated. No sooner was the prospectus published than it met with the utmost opposition, and in the course of the criticism which appeared, it transpired (or perhaps, we should say, it was stated) that for the patent rights for which £75,000 was asked, the original vendor had received the sum of about £2,000 only; thus showing a neat little profit of £73,000 to find its way into the pockets of the promoters!

We have a Rapid before us as we write, but entirely fail to perceive in what manner it is more rapid than any other machine—if, indeed, it were so fast. A writer once hit the nail on the head exactly when he said, that the most rapid feature about the Rapid was the rapid manner in which it disappeared.

The Pneumatic.

This machine was announced in London in about the year 1894, and embodied the same principle of type-thrusts as the foregoing. It was, however, based upon an original and interesting idea, that is to say, the motive power governing the movement of the type-bars was obtained by the expulsion of air from a series of small chambers each of which was marked with a letter denoting the type affected. In other words, in place of the usual keys a series of india rubber balls were arranged in rows. At the lower end of each ball was an india rubber tube, and

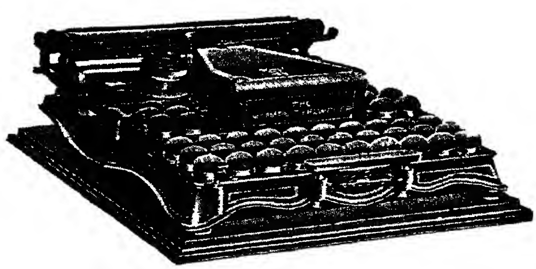


Fig. 102

ne
The
return
orks with
attached to this tube was a metal tube. ne Granville
figures, and signs, were formed on the end reach it. In
which were made to slide in these metal tu here can be no
the ball, or collapsible chamber, the expuls reached with it,
with it the type-rod, which returned to reason why mani-
on pressure being removed. The h machines in which
the machine was exceedingly s is.

which we have, executed by the Pneumatic are as clear and well defined in all respects as could be wished, and it was unfortunate that the attempt to place the Pneumatic on the market should have proved abortive.

It has, however, been suggested that the amount of force with which each air chamber was struck would require to be exceedingly regular. It is probable, also, that variations of atmospheric conditions might prove troublesome. On these points we can say nothing but we should certainly like to see another attempt made to set the Pneumatic on its feet. The price at which it was to be sold was twelve guineas, and machines were intended to be made, fitted either with the Remington, the Hammond, or the Caligraph keyboard. The inventor's name, it should be mentioned, was Marshall A. Weir (of London).

The Ford.

This is a most ingenious piece of work, and, is an exceedingly compact machine. The special features claimed on behalf of the Ford may be thus enumerated. Visible writing: everything down to the last letter written being in absolute sight. Permanent alignment: the type-bar not being bent or twisted as in other high class makes, the result is a perfect and unalterable alignment which remains unchanged by use or wear Speed is one of its most remarkable points. In order to prevent the type-bars colliding,

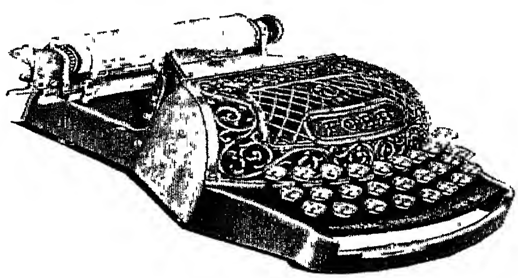


FIG 103

necessary that the bars should withdraw only one
of an inch, when a free passage is left for the
ar to meet the printing point. The carriage
luminium, and runs on ball bearings. The
be very light, and the depression of the
an inch. The keyboard follows the
ement, and works with a double shift.
g arranged in a compact semi-circle,
stantly cleaned, and the ribbon

Shortly afte
was made to floa
Rapid. A capit
this sum it was sta
vendor to the Compan
posed Company, however,

can be changed in a moment. The convenient form of the shift-keys can be readily noticed and the usual conveniences are supplied for the regulation of margins, bell trip, and so on.

Two forms of the Ford are made. The one is made wholly of aluminium and weighs 11 lbs., the other has an iron frame and weighs 16 lbs. The Ford stands five inches high, and appears to be a well-made and serviceable article.

The Ford shift-key arrangement is peculiar, and merits special mention. The type-bars are hinged, and on the depression of the shift-key, the platform over which the bars slide on their way to the printing point tilts, carrying with it the moving bar.

The Granville Automatic.

This machine is one of those which one ought to sympathise with, but cannot. Certainly if one expects size for money one gets it in the Granville, although it is not unduly heavy.

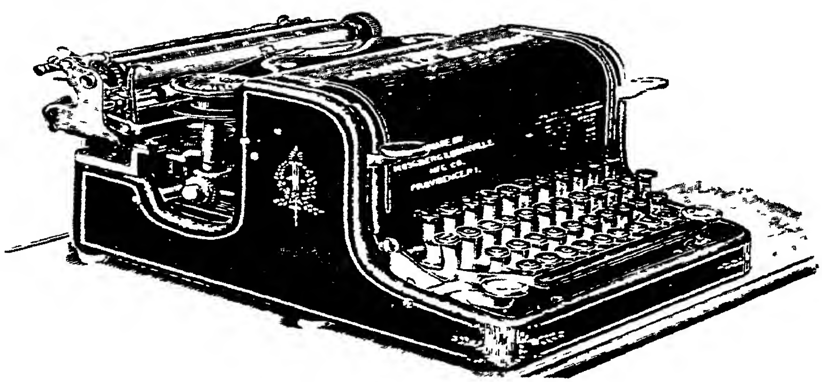


FIG 104

The Granville is a more recent form of the Rapid, whose career has already been recounted. But in the Granville a complete fount of type is provided. The previously mentioned automatic keys for carriage return and platen lift are repeated, and the machine works with a single shift-key. The operative parts of the Granville are all enclosed, so that very little dust can reach it. In general appearance it is handsome. There can be no doubt that a fairly high speed can be reached with it, but there would appear to be no special reason why manifolding can be more effective than with machines in which the types strike in other directions

When originally placed upon the English market, the Granville occupied very handsome premises in Cornhill. Soon afterwards, however (it may have been a year or less), we noticed that the machines were being sold at a reduction, and the premises were to let. Six months later the machine was being advertised as being sold at half price, and now, if our information be correct, the sale of the machine has been discontinued.

The Empire.

Although not actually made in England, this machine is our first cousin, since it is made in Montreal, Canada. In the United States it is known as the Wellington, and on the European continent it is made under license to a Mr. Adler, whose greatest change in the instrument is to give it his own name.

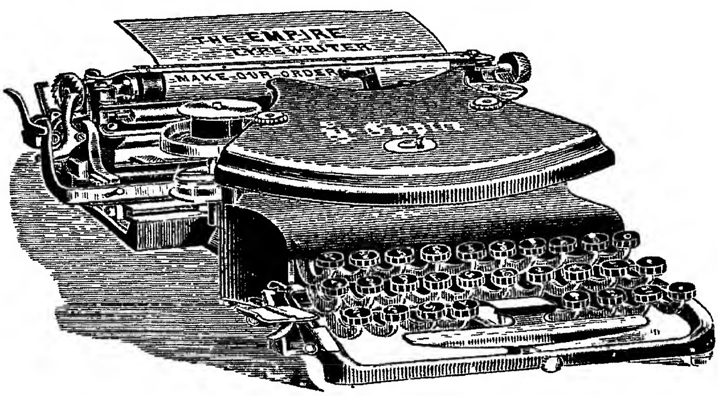


FIG 105

The chief characteristics of the Empire are stated to be :—

(1) The simplicity of its construction.
(2) The permanency of its alignment.
(3) The extreme portability of the machine.
(4) Its great durability.
(5) Absolute visibility of writing.
(6) Manifolding ability.

To these points may be added the fact that the Empire has the universal keyboard, employing twenty-eight keys operated with a single double action shift-key. The range of type includes beside the two alphabets (*i.e.*, upper and lower case) the ten figures, all the usual commercial and literary signs, as well as the punctuation marks The comma and period are in triplicate, that is to say, either of these signs can be written with lower or upper case,

or with figures; so that if the shift-key be locked for capitals or figures, there is no need to unlock the same to provide either of these useful and commonly occurring marks. This is a little point of great convenience, only too often overlooked in arranging the keyboards of many machines.

Technically or mechanically speaking, the Empire may be said to have a series of twenty-eight thrusting type-bars radially mounted on a horizontal plane, and converging to a common central point, from which deflection is impossible. Putting this into plainer English, we may say that the type-bars all rest on the surface of a metal platform, the bars themselves being arranged very much in the shape of a fan. On the depression of a key, the type end of the bar moves forward till it meets the paper round the platen. Figures 1 and 2 will show the movement.

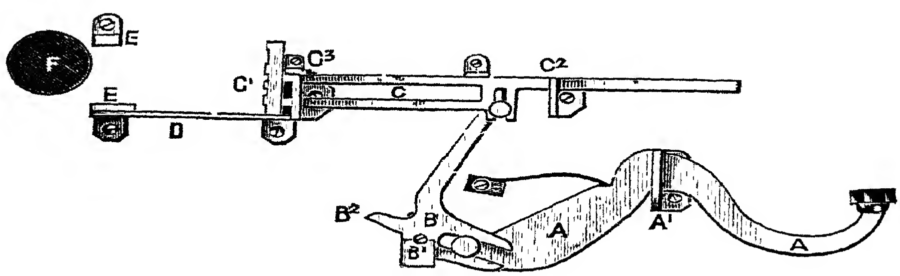


FIG. 106

In Figure 1 the type-bar is at rest. The curved piece AA is the key-lever, the fulcrum of which is at A1. At the further end of the lever is a button which catches the forked end of the "T" or connecting lever B. This

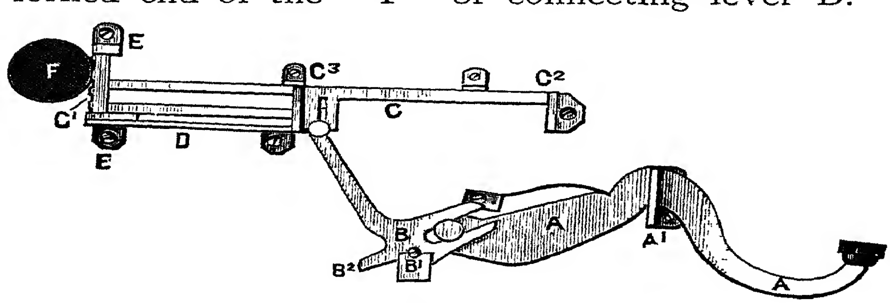


FIG. 107

s swung on a pivot at B1. The upper end of B engages n the slot at the underneath edge of the type-bar CC. D is the platform before referred to, and EE are guides

which direct the type to its true position and hold it during its stay at the printing point. F is the paper roll.

On the depression of a key, the further end of the lever rises, and carrying with it the forked end of the "T" lever B, throws the top end forward. As this top end engages in the slot in CC it is obvious that in its movement it carries with it the type-bar. The effect of this is clearly shown in Figure 2.

On the pressure being taken off the finger-key, the small spring shown between A and B presses in the notch or shoulder of A, and, forcing it down, causes the whole movement to revert to the original position. It is worthy of note that at the moment of printing the type-bar is held firmly in the first place by passing through a slot at C2, then by passing under the framework of the machine shown between C2 and C3. It next passes through a comb at C3, and finally reaches the printing point as before mentioned, where it is held by EE against all movement, either upward or downward, or to the right or left. The bar is thus locked, "lock, stock and barrel."

The type itself is firmly rivetted to the type-bar, so that the very annoying sympton so frequently met with in some machines when they begin to grow old, of having their types fall out, is one which, however old an Empire may be, will not arise. It is also to be noticed that, owing to the manner in which the types are mounted, it is impossible for two colliding bars to result in damage either to the face of the type, or the alignment, or the machine itself.

The whole movement of the machine may be seen by unscrewing the two small milled edge screws on the top of the machine, and removing the top plate. Beneath the top plate will be seen the bars arranged on their knife edges. It will be seen that the distance from the type end of the bar to the printing point is only a couple of inches. This small space is the only distance over which they have to travel, so that the movement is very short and rapid, and, necessarily, light. It has been urged that in comparison with some machines where the type bar is made to swing on a pivot and is four inches long, and has to sweep upward or downward through a quarter circle of say six inches, the Empire movement is scarcely perceptible, and the strain and wear and tear exceedingly minute.

The carriage is easily removable for the purpose of cleaning or repair. The paper is fed from a shelf at the

back of the machine, passing through two roller upwards, under a scale. The scale is held down by springs, and whilst affording all the assistance sought from similar devices (although a scale is hardly necessary on the Empire) serves also to keep the paper in its place.

In using the shift-key, it will be observed that it is divided into two portions. That nearest the operator is for capitals, the further side being for figures. On touching the capital shift the roller is carried downward one step, just sufficient to bring it under the capital letters. The same key, when pressed on the outer side, causes the carriage to sink two steps. The shift-key is one of the most ingenious and simple pieces of mechanism possible, and should be specially noted when examining the Empire.

The ribbons are mounted on spools at the side of the machine, and are readily interchangeable. The ribbon itself is rather wide, when exhausted at one edge by the greater use of small letters may be turned over and used again. It is reversed in half a second by merely sliding the knob on the circular disc in the top-plate half way round.

The margins are easily adjustable, both for left and right hand sides, and the bell and other similar points are fully equal to all demands. The platen revolves in either direction, and permits of the writing being executed on ruled lines, etc. The Empire is undoubtedly a good manifolder, and turns out some admirable stencils.

Another very commendable point in the Empire typewriter is this: It is an exceedingly pleasant machine to work with. The fact that there is very little bright metal to come between the operator and the limit of his vision, is very soothing to the eye. It is a feature which will especially commend itself to those who have sat, under a blazing sun, operating for hours at a stretch, a machine ornamented with a lot of polished nickel work. Typewriting is not, of itself, injurious to the eyes, as is often alleged, but it is the shining plated metal-work so often met with, and which makes a machine so very attractive to the unwary, that is to be avoided if eyes are regarded as valuable assets.

CHAPTER V.

Carriage placed Centrally.

THE gods must have loved the four machines which follow, for they all died young. Two of them were English, a third was made in England, and the fourth, the Brooks, although placed upon the English market, was not pushed in any way, and consequently soon became forgotten. They were all very good machines in their own way, and their fate shows that Death, the leveller, pays no regard to place of origin.

The Fitch.

As will be seen by the illustration, the Fitch presents a very neat and tasty appearance. The type-bars rest overhead, and on the depression of a key the corresponding bar descends, and passing along the projecting arm, strikes in its descent the small inking roller, which then moves aside. The bars are quite loose in their bearings, but by reason of the guide-arms, all strike to a common printing point.

The keyboard of the Fitch is an original one, the arrangement being as follows :—

X	B	M	R	N	G	T	L	P
!	2	3	4	5	6	7	8	9
J	W	O	A	E	I	U	K	Q
,	"	:	;	.	,	-	$	?

V	S	D	H	Y	C	F	Z
(	1	/	—	's	%	&	)

The action of the shift-key is peculiar, it being raised in order to produce the figures, and depressed to print the

capital letters. It can be locked to print capitals or figures continuously. The types are made, not in metal, but in hardened vulcanite.

The difficulty in the machine is the inking arrangement. in order to re-ink the roller, a few drops of the special ink are spread on a piece of glass or stiff paper, and the roller rubbed over it. Should the roller be made too wet, the ink is apt to splash all over the paper.

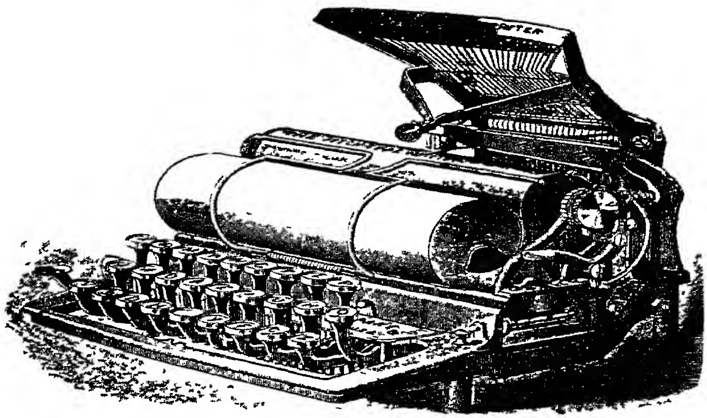


FIG 108

The first patent in respect of the Fitch, was made about twenty years since, and various improvements were subsequently made. On the machine being placed on the American market, it failed to meet with success. The right to manufacture was thereupon granted to an English company, and machines were made in London. Whilst so made, a form of the machine was produced employing script letters (not italics, but round hand), the work turned out on this machine presented an exceedingly attractive appearance. For some reason, however, either on account of the inking device, or possibly by reason of the terrible clatter which the machine made when being operated with any degree of speed, or it may be because of its peculiar keyboard, the Fitch failed to make its way, and the company ceased operations. At the sale which took place at the factory machines were sold at amusingly low prices, and somebody must have been very heavy losers.

The Fitch claimed to have been the first machine which permitted the writing to be executed in sight of the operator, and its weight was only eleven pounds.

The Brooks.

The inventor of the Brooks typewriter is Mr. Byron A. Brooks, who is stated to have been a pioneer in the typewriting field, and his machine is said to present the culmination of a lifetime devoted to typewriter invention. Its general appearance may be gathered from the illustration. It will be noticed that the order of the keyboard follows the standard arrangement, and works with two shifts. The depression of the keys is about five-eighths of an inch, whilst the force required to "down" them is only seven ounces. The result is that the Brooks is a very easy machine to work with, and the touch being so light an operator may work for a considerable time without

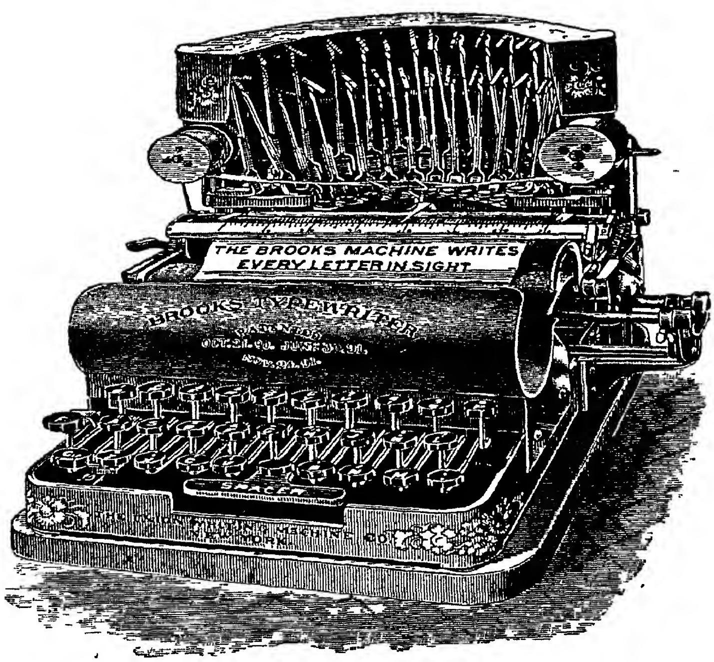


Fig. 109

feeling fatigued. The writing as will be gathered, is perfectly visible, and it is claimed that as a manifolder, the Brooks is far superior to all other machines. The ribbon movement is peculiar, as it feeds transversely at each impression, and longitudinally between words. The weight of the Brooks is about seventeen pounds, and its dimensions are $9\frac{1}{2} \times 14 \times 14\frac{1}{2}$ inches.

The type-bars in the Brooks are constructed on a new principle. The pivot, instead of being part of the type-bar is rigidly driven into the hanger, and is of twice the length and size of those attached to the type-bar. The wearing point is thus much more extended, with the result that the alignment is rendered more lasting. The mechanism of the machine is very simple, there being only some 600 parts therein. The space after a word can be made simultaneously with the last letter in the word. This feature is only possessed by the Waverley, some models of the Blick, and the Brooks. Among other features claimed for it are the following :—There is an automatic line lock, preventing letters from being piled up at the end of the line of writing The platen can be easily removed, and the upper carriage with the paper in its place, may also be easily taken off. An extra wide carriage can be fixed on the smaller machine. The key levers have uniform depression and leverage. It feeds paper nine inches wide and writes a line of seven and a half inches. The exact printing point is indicated by a pointer, and the ribbon is easily removed and readily reversed. The platen can be revolved in any direction, whilst the bell trip may be adjusted to ring at any desired spot ; all of which features are now regarded as essential in a first-class machine.

The Waverley Typewriter.

This machine, which was first placed upon the market in about 1896, was of English invention and manufacture, having been patented by Messrs. Higgins & Jenkins, and made at Clapham, London.

The type-bars stood erect, striking down on top of the platen towards the operator. The inking was effected by means of a ribbon, and the universal keyboard, with one shift-key, was employed.

But although employing a shift-key, the method by which the Waverley machine changed from lower case to capitals was altogether different to that of any other typewriter. So far as the type-bars were concerned, a separate bar was provided for every character used on the machine, seventy-six in all. On the depression of the hift-key, the practical effect was to unhook the connecting wire between the further end of the lever and the type-bar and hook it on to the connecting wire of the capital type-bar. The advantage secured by this device was, that it was impossible for the capitals or lower case letters to print

out of the true line owing to the failure of the carriage to return quickly enough, nor could the half of a small and half of a capital letter print, as may often be seen when typing is very hurriedly performed by operators who are not absolutely competent workers. Means were also

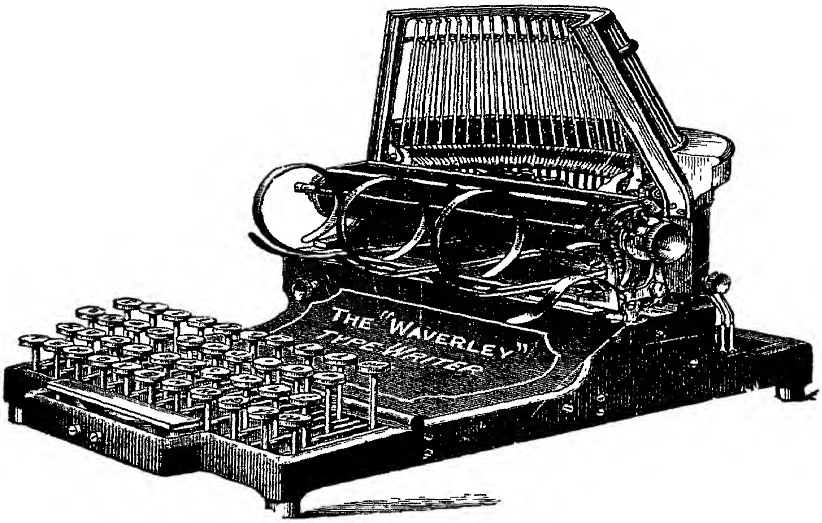


FIG. 110

provided for taking up any wear that might show itself in the type-bars, and a further provision was made to secure alignment by directing the bar, in its downward movement, through the teeth of a comb, a device which is found in various forms, in many other machines.

The Waverley also adopted the principle of differential or variable spacing, as illustrated in the case of the Maskelyne. To secure this end, means were provided whereby, on the depression of a medium or wide spaced letter key, a sliding collar moved out of the way of the loose dog, which was thereby permitted to move back two or three spaces, according to the width of the letter. But the Waverley system of differential spacing varied somewhat from the Maskelyne, since in the latter the proportion of widths was taken as 1, 2, 3, 4, and in the Waverley they were 1, 2, 3. As in the Maskelyne, however, the results were very neat and good, and produced work bearing a very strong resemblance to ordinary printing, although the blur caused through printing by means of a ribbon prevented the real effect being shown. The effort to obtain results as nearly as possible like actual printing

has made itself manifest in many ways, and one of the latest devices in this respect is a peculiar fount of type fitted to the Yost machine, called "Imperial type" in which the effects of thin and thick lines are (owing to the fact that the Yost uses a pad), very beautifully distinguished.

It is curious also, that of the four machines falling within the present chapter, two of them should have stood alone in the adoption of a device for securing terminal spacing. It was considered that if, simultaneously with the strikiug of the last letter in a word another key could be struck and the space at the end of a word made at the same time, at least twenty per cent of the work of the operator would be performed automatically, and, of course, a corresponding saving of the time made. Save only in the case of the Waverley and the Brooks, and some models of the Blickensderfer, to which we shall make reference hereafter, we cannot recall any other machines using this device. Of course, in the case of spacing out, for headings and so on, and display work generally, the advantage of this addition to the machine was very great, but there is little room for doubt, that after the operator has been taught to use the spacer after every word, the effort to remember to strike the two keys simultaneously must have caused hesitation, and thus involved the loss of more time than was otherwise gained.

The paper was fed in under the scale bar, which thus served as a pressure bar to keep it in order and snug to the platen, and after being typed upon passed round the platen into a receiver in front of the carriage. Thus, only one or two lines of writing were really visible, but of those which were, there could be no doubt as to the visibility.

The usual convenience for varying line space, automatic line spacing with return of carriage, margin stops, warning bell, etc., were provided for. The right hand margin stop consisted of a collar sliding on a screw, and could be thrown out of position by a mere touch of the hand, when desired, in order to insert marginal notes.

The Waverley weighed about eighteen and a half lbs. It was a magnificent piece of work, but the Company did not last long. At the proceedings in connection with the winding up, it was stated that so far as the machine itself was concerned, it had proved a commercial success, but the further exploitation thereof was rendered impossible for want of sufficient capital.

North's Typewriter.

When the company manufacturing the English type-writer closed down, the works, plant and tools were taken over by the late Colonel North, whose interest in mechanics had long been known, and arrangements made to place upon the market an entirely new machine of which the two

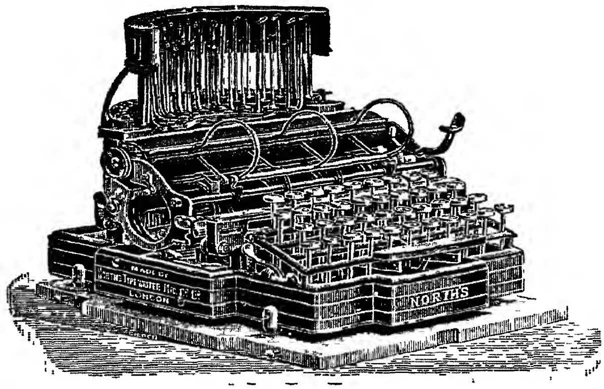


FIG. 111

principal features were to be absolutely visible writing and everything in front of the type-bars, so that the operator could do anything required to manipulate the machine, whether to set his margins, reverse his ribbon, and so on. without rising from his seat or turning the machine round,

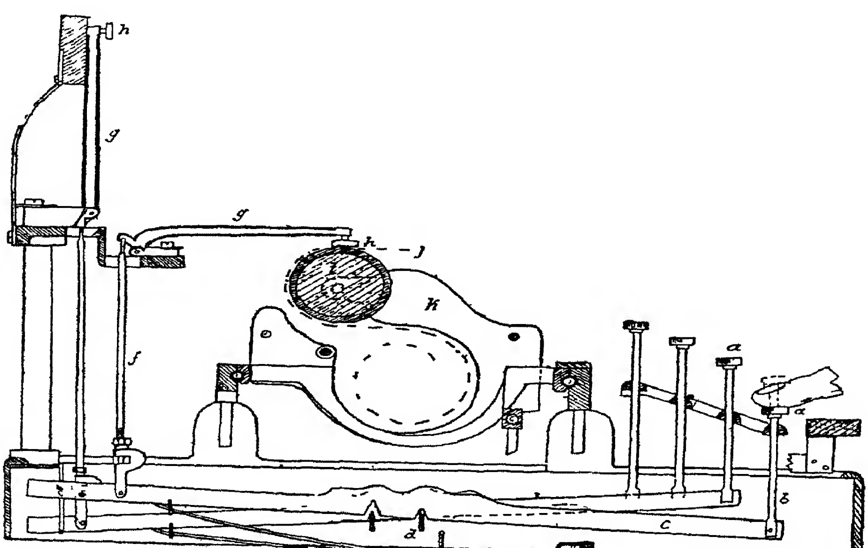


FIG. 112

The result was the machine to which the Colonel gave his name. It was a single shift-key machine, the keys following the universal order. The types were fixed to the end of bars standing erect, striking down on top of the platen before the operator.

There was an entire absence of little devices on the North's. It did not claim to be anything else than a writing machine. But it was that, and it did its work well, and rapidly, and the touch was not at all unpleasant or heavy.

Another very interesting feature of the North was the fact that the carriage was entirely open, that is to say, the paper did not feed round the platen, but over it, and so any width of paper, from the postage stamp so commonly referred to in this connection, to paper a couple of yards wide, could be used in the machine, although, of course, the length of the writing line was confined to the actual width of the platen. It was, therefore, to all practical intents, a brief machine, since one hundred letters and spaces could be written to the line. It was a most perfect manifolder, the heavy downward blow giving many good clean carbon copies; whilst, since no folding of margins of the waxed paper was necessary, the very highest class of stencil work was possible.

The ribbon was a narrow one, and was carried on two spools down in the well of the machine, passing up over and round a hinged ribbon carrier, and then down to the other spool. It was not automatic in its action but required personal reversing. Owing to the position of the spools, a much shorter ribbon than usual was used. The margin stops were also very crude, being a metal peg placed in one of a series of holes at intervals of five letter spaces. There was no keyboard lock at the end of the line, and the only way to write outside margins was to displace the margin stop. The machine was fairly noisy.

CHAPTER VI.

Typewheel Machines.

The Hammond.

THE marvellous pieces of mechanism which owe their existence to the creative power of James Bartlett Hammond, are the outcome of a protest against the tediousness of longhand writing. The facility as a shorthand writer which he had acquired in the course of his collegiate training had brought about a feeling of repugnance at longhand writing, and this feeling grew day by day, until at last Mr. Hammond found himself designing and sketching out a device which should serve as a substitute for the pen, and permit of a facile operation of mechanical principles which should render easy that which heretofore had been so laborious. As a student, he had acquired some acquaintance with mechanics, but lacked a practical knowledge of the use of tools, which necessarily added to the difficulties before him. However, the dream of what might be continued ever present, and at last Mr. Hammond found himself engaged in working out a machine, having for its fundamental idea the plan of imprinting letters by the depression of corresponding keys, in the same way that a pianoforte, by depressing the requisite keys, gave forth musical sounds.

At this time Mr. Hammond had not heard of the labours of Sholes and Gliddon, and the other members of that small band of experimentalists who were labouring, against all odds, to improve the fine art of writing. Within a year or so, however, he became aware of their efforts, but an inspection of their work, and a perusal of the patents issued to them, convinced Mr. Hammond that his own ideas were preferable, and likely to lead to better results.

At the time he made his resolve to persevere with his invention he encountered three of the most powerful opponents that could be met with. He fell ill, he suffered

from want of funds, and in lieu of meeting with that encouragement from his friends which he had a right to expect, received nothing but a series of rebuffs and chilly receptions. No results of importance attended his efforts for many a long year. The type-wheel, the backbone of his ideas, was obstinate, and as a writer has observed, "momentum of the wheel seemed to be a fatal and impassable barrier to the accomplishment of his purpose." But all this time models were being constantly made, and in 1876 the fame of one of these models reached the manufacturers of the Remington, who sent our hero an invitation to visit the works at Ilion, and submit to them his ideas This visit was paid, the machine exhibited, and for more than a year it was experimented with at the workshops, but without any of the essential difficulties that faced his inventor being successfully overcome, and at last, disappointed but not disheartened, Mr. Hammond removed his models, and again set about the problems before him. The most inveterate opponent of the Hammond will admit his merits as a piece of mechanical skill and as a triumph over difficulties, but not one in a hundred is aware that the charm and beauty, the cunningly devised schemes, and the daringly original ideas embodied in the machine, were evolved in the midst of continual and excruciating pain.

The machine, however, was not yet in shape. A long series of experiments was now undertaken, extending over a period of two and a half years, for the purpose of perfceting its details. Finally, about 1880, a small factory was set up in Grove Street, New York City, for the purpose of producing the machines. Some parts, however, continued to appear hopelessly incorrigible. This was more particularly so with the typewheel. Four years were spent in removing these further difficulties, and at last, in 1884, eight years after the visit to Ilion, a few machines were made and put on the market. From that time forward, the success of the machine was assured, and to-day the Hammond counts among the world's great typewriters. Not only this, but as a writer once remarked, "Amidst the fire of mutual recrimination so freely indulged in by rival makers of machines, the Hammond enjoys a certain immunity and respect, shared, perhaps, by no other."

The idea of the typewheel will at once suggest to the curious reader the possibility of difficulties not to be encountered in those machines having type-bars. The motion

of a laterally moving wheel by means of type-levers will appear to be a severe problem to master. Even if this point is got over, the impact of paper and type remains to be accomplished. Simultaneously with this, the spacing must be made and the ribbon fed. It has already been pointed out what difficulties the makers of the first machines had to meet and surmount. It will not be saying one word of disparagement to them to say that their labours were simple in comparison to the task which Mr. Hammond took in hand.

The earlier forms of the Hammond which were placed on the market presented a very different appearance to

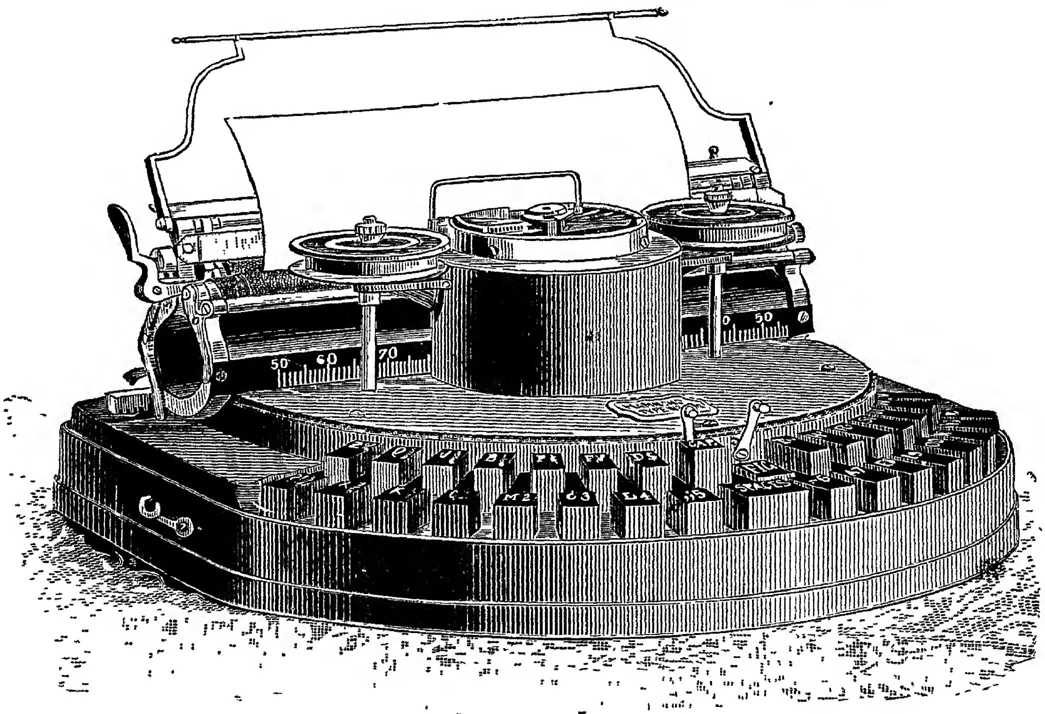
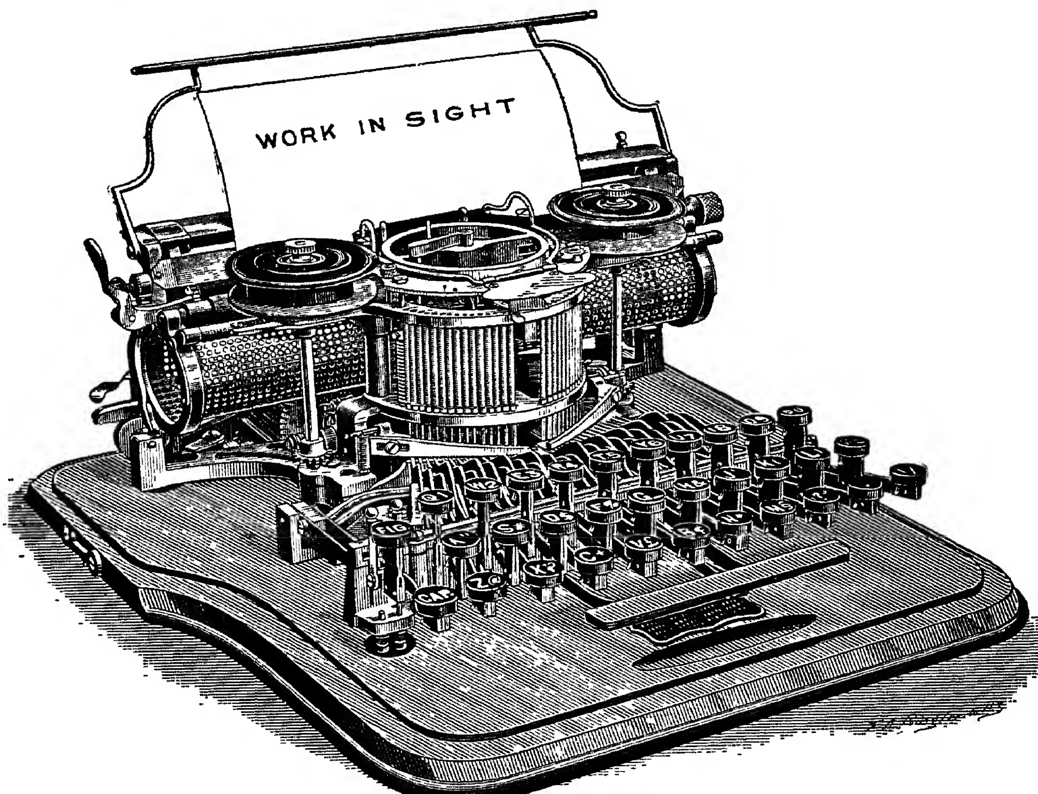


FIG 113

those which are now to be found. At the rear of the keyboard the whole of the space occupied by the levers was covered in, and the turret-like structure containing the typewheel and its works was also inclosed. We present an illustration of one of these old Hammonds Graceful as it was then, its appearance has been highly improved, by the omission of the shields, and by way of comparison we also illustrate a Hammond in the second stage of its career.

The Hammond is known as a typewheel, as distinguished from a type-bar machine. In the latter the type is attached at the ends of a series of bars, which are pivoted in a circular frame, each bar making its own impression on the paper. In the Hammond the position is reversed, the type being cast in one integral piece, called the shuttle, which is oscillated upon the outer edge of an annular ring, called the anvil, the desired letter being brought into position in front of a hammer, which, under the impulse of a spring, drives the paper against the type. The primary object of this arrangement is to secure perfect alignment and a uniform impression.



Fig

To enable the operator to see his work, the circular frame surrounding the anvil, which holds the type shield and the ribbon, is arranged so that it can be temporarily depressed, returning to position again on being released. In this way the work is kept in sight, and the lifting of the body of the machine is avoided.

To change one type shuttle for another, the anvil is raised until the type shuttle web clears the end of the shuttle arm, when the web of the shuttle can be drawn forward out of the groove in the anvil and another shuttle put in place. As each shuttle contains a complete alphabet, the variations that are possible are very numerous, and are constantly receiving additions.

The margin is set by means of a margin block at the rear of the machine. Should it be desired to make any marginal note outside the margin, means are provided whereby this can be readily done. Cards or paper of any width can be written upon, and a very useful adjunct to the machine is a back spacing key, which carries the carriage to the left, and thus permits any desired position to be readily obtained.

Among the minor conveniences which the No. 2 Hammond presents to its patrons may be mentioned a paper guide, for securing the straightness of margins; the line space can be regulated to four degrees, as against three only in all other standard machines; the paper can be very readily fed upward and laid on the erasing plate should it be desired to make corrections; the force of the blow of the hammer can be increased when it is desired to make carbon copies or mimeographic stencils; the ribbons may be removed and others substituted very readily; and a great number of little points not found in other machines are presented in the Hammond.

Owing to the peculiar nature of the escapement, it is impossible to pile up letters one on top of the other at the end of a line, and the same feature prevents the space-bar to be written across it.

However irregular an operator may be in his fingering, the print on the Hammond is always uniform. It is this uniformity which distinguishes Hammond work from all others.

In addition to the Ideal and Universal forms of the keyboard, the Hammond is now supplied in a Clergyman's style, giving a wider space between the letters, and with an extra wide carriage. There is also the Greek Hammond which, employing as it does 120 types, is, perhaps, the most complete typewriter at present on the market.

An improved model embracing a number of entirely new features, *e.g.*, perfectly visible writing, two colour ribbon, etc., was issued in 1906.

The Blickensderfer.

The Blickensderfer typewriters—for there are several of them—are the production of Mr. G. C. Blickensderfer and are made by the Company bearing that name at Stamford, Connecticut, in the United States. Two of the earlier models, the No. 1 and the No. 3 are no longer made, but the No. 5, which is the chief favourite, has been on the English market since 1895 and like the famous play of Pinero, is "still running." The No. 7 is a much statelier instrument and includes a number of little conveniences not found in the earlier and lower priced model.

There are also the Electric and Niagara, the latter being a very cheap Index machine. Accounts of these two instruments will be found in later sections of this volume.

The No. 1 Blick was made to sell at $100, and like the Waverley and the Brookes already described had an automatic terminal spacing device, an automatically returning carriage and line spacer. It was fitted with a tabulating device, and an attachment for rapid ruling in red and black and permitted of an easy interchange of platens up to any width made.

The No. 3 Blick was lighter and smaller than the No. 1 and although following very similar design did not incorporate the automatic carriage return nor the ruling device. Its weight was eight pounds, being two pounds less than the No. 1.

The No. 5 Blick, introduced into this country by Mr. J. M. Rimington of Newcastle-on-Tyne, whose business was in 1904 registered as a limited liability Company under the style of The Blickensderfer Typewriter Co., Ltd. It is upon this model that the fame of the machine mainly rests.

It was the first keyboard machine, which was sold at a low price, and notwithstanding the novelty of its principles, and the fact that it was from the first handicapped with a special keyboard, it very quickly established itself as a favourite, especially among private users and travellers. As with practically every other wheel machine the Blick has two shift-keys. The method whereby it works may be gathered from the following extract from a pamphlet written by the author of the present work in 1896:

"By pressing down a key, say the D key, we notice that an upright arm, having cogged teeth at its side, is slightly revolved. It will be desirable to understand how this

Some "Blick" Models.

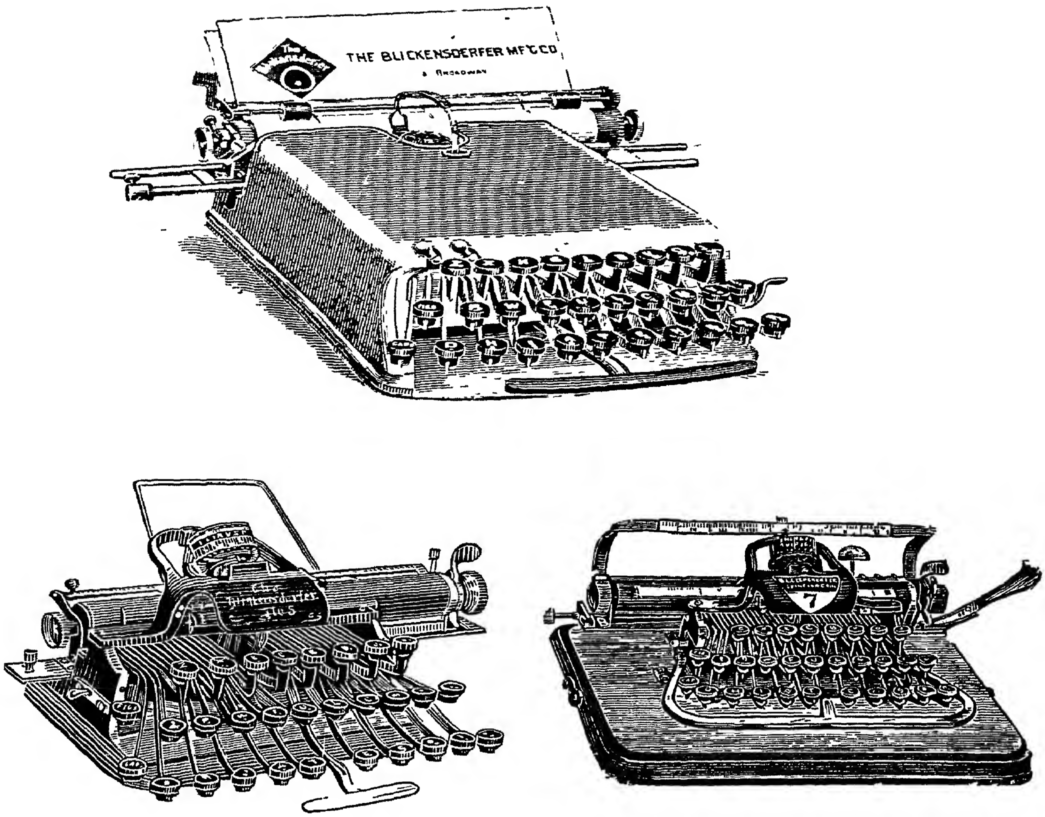


FIG 115

movement is made before going any further. Still keeping our attention on the D key, let us follow its direction.

"The key is attached to a steel lever which passes through a slotted comb, then through the body of the machine, and finally out at the rear portion, where it terminates in a kind of hook, technically called a toe, resting on a metal rod, which latter serves as its fulcrum. Attached to this metal rod, but inside the body of the machine, and therefore out of sight, will be seen, on looking closely, two oscillating shafts, and if we again touch a key we notice that it causes one of these shafts to move downward. Each lever affects this shaft in a greater or lesser degree, and since the shaft causes the cogged arm named above to rock, it follows that the extent of the movement of the typewheel depends upon the extent of the movement of the shaft.

"During the time the typewheel is revolving, the spindle upon which it rests is gradually falling, until at last it meets the paper.

"In the course of the movement, however, two other things happen. Just below the typewheel will be observed a cogged wheel. When the type is almost at its destination, the teeth on this wheel engage in a little arm which will be observed pointing upward. This arm effectually locks the wheel during the act of printing, and keeps each letter in its exact place.

"At the back of the typewheel will be observed a projecting bracket, having a swinging arm on which, by means of a pin passing through its fork-like end, is carried a small inking roller. As the typewheel, which has already revolved so as to bring the desired letter opposite the printing point descends, it strikes this roller, which imparts to the required letter just sufficient ink to produce a good impression, and the roller is then pushed back out of the way.

"Simultaneously with the release of the key, the typewheel resumes its proper position, and the carriage moves along one tooth of the saw-like rack, and everything is in readiness to print another letter."

The machine provides for margin stops (after a fashion of its own) has the usual warning bell and so on.

The No. 7 Blick was brought to this country in 1897. Although following, so far as the general mechanism goes, the plan of the No. 5 it contains a number of very important additions. The typewheel, inking device, and keyboard remain the same. The space bar extends the whole width of the machine. The bell trip is improved, and a large handle at the right greatly facilitates the return of the carriage. An elevated scale "pointed" with the top of the typewheel shaft adds considerably to the facility for executing tabular work. The marginal arrangements are improved. In the No. 5 there are three projections in different positions on the base plate of the machine, and a pin is fixed in corresponding holes in the carriage, in order to engage with the desired stop. In the No. 7 however a latch slides along a screw rod and can be fixed in any place, whilst to insert marginal notes, it is only necessary to throw the latch back to permit the carriage to pass. The line space can be regulated to any desired width, and an automatic pointer assists in finding the writing line and the spot at which the next letter will strike.

In all the Blickensderfer machines, the typewheels are readily removed, and new ink pads are easily affixed.

They are surprisingly good manifolders, and cut very fair stencils. They are not likely to get out of order and are all round, good machines. The keyboard is arranged thus :—

Z X K G B V Q J
& P W F U L C W M Y
D H I A T E N S O R

and that this arrangement is a purely scientific one may be gauged from the fact that no less than 70 per cent. of the letters in any ordinary piece of composition may be written by means of the bottom line.

The Gardner.

This machine was the child of the Gardner British Typewriter Co., Ltd., and was manufactured at their works in Carr Street, Manchester.

It is stated to have been designed to meet the demand for a low priced typewriter, which should be thoroughly serviceable, and capable of a speed equal to that of the higher priced machines. In order to attain this end, the parts were reduced to the lowest possible number, and the power of manifolding was not sought.

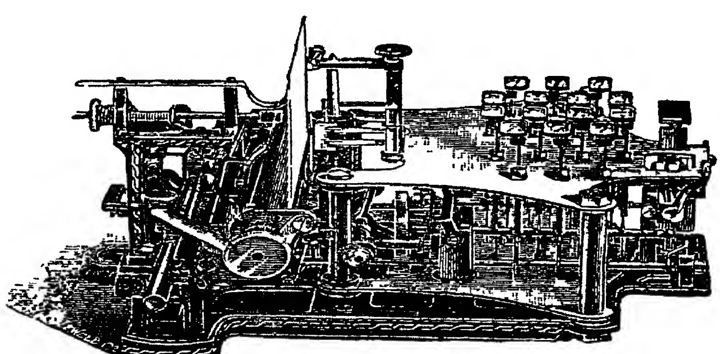


FIG 116

The makers, in seeking their end, introduced into the machine a principle, novel in typewriters, but well known in some musical instruments, that is to say, the simultaneous depression of two keys in order to produce the effect of a third. The arrangement of the keys on the keyboard

assumed several forms, and various changes in parts of the machine were from time to time made.

The keys are lozenge-shaped, one half being printed in red, and the other in black. In order to produce the black characters, the necessary key was depressed, while to print the red characters the key was depressed simultaneously with the space key. It was suggested that the easiest way of doing this was to use the hand at right angles with the keyboard, and to invariably use the thumb to lower the space key. In addition to using the two keys in order to produce some letters, there were also capital and figure shift-keys, and when either of these were required to be used, it followed that three keys had to be used at the same moment.

The types were formed of a small square of india rubber, which was rolled on a sleeve, the base of which was formed of a series of corrugations similar to the Crandall, (which may, perhaps, have suggested the Gardner) and the sleeve was actuated by means of a twirler arm. On the desired character being brought opposite the printing point, the continued depression of the key let loose a hammer, which brought the paper into contact with the type. This hammer was in some models the shape of a thin slip of leather-covered metal, running the entire length of the carriage, whilst in others a forward striking plunger was used.

The inking arrangements were simple, consisting of two small inking rollers, working on pivots at both sides of the typewheel. They could be removed easily enough, but were not quite so easy to replace. The typewheel could be removed by taking out a screw, and various styles of type were to be had.

The touch of the Gardner, however, was something fearful to contemplate, and the shield which kept the paper from touching the type-sleeve had a playful habit of jumping up, and remaining there, so that it would sometimes happen that a line or two of writing would find its way on to the shield. Under these circumstances, with perhaps others, the Company found its way into the harbour of the Liquidator in the middle of 1895.

The Crandall.

This machine is the invention of Mr. Lucien S. Crandall, whose earlier invention, the International, we have already described in the first group. The Crandall is made at

Groton, New York, and the Crandall Machine Company, who control the patent rights, have offices at New York, Chicago, and various other places throughout the United States.

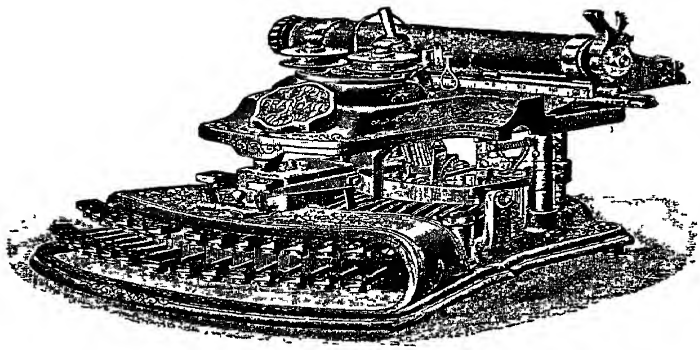


FIG. 117

Two models of the machine are made. One termed the Model Crandall No. 2 (of which we present an illustration herewith) being an exceedingly pretty machine, having a specially arranged keyboard, as follows :—

Z P R C H M I L F E S D B K
J V X U N W . , T O A G Y Q

and selling at fifty dollars

The other model is termed The Universal Crandall No. 3 and has the standard keyboard.

This machine present a different outline to the other, is fitted with latest developments of the machine, and sells at seventy-five dollars.

The general mechanism of both models is practically the same. The types are described as being printer's faces, mounted on a type-sleeve, three and a half inches long, and half an inch in diameter. The lower portion of this sleeve is bevelled out into a series of cog-like grooves, and when a key is depressed, and the lever actuates a twirler arm, the teeth in which engaging in the grooves, cause the type-sleeve to revolve. In the type-sleeve, just below the letters, are a series of holes, and when, by means of continued pressure on the finger key, the sleeve is forced to descend and meet the paper, a locking pin enters the hole, corresponding with the letter or sign about to be printed, and so holds it firmly during the act of impression. It is in this system of locking that the possible weakness

of the Crandall may be found, since the constant insertion of the pin will, in time, cause the sides of the holes to wear, and as the result, play of the sleeve becomes possible, and demoralised alignment necessarily follows. At the same time, it is but fair to state that the type-sleeves are replaceable at a very low cost (three dollars for the No. 2 and four for the No. 3 machine) and so this evil can be readily remedied.

Quite a large assortment of type-sleeves is held in stock, from which a selection can be made ; and the various languages represented are Spanish, French, German, Swedish, Italian, Danish, Polonion, Russian, etc. In addition to these, a number of styles of English type can be had, either small, large or medium in size ; also italic, large and small, capitals and so forth.

The ribbon works on two spools very similar to the Hammond and is supplied with an extra pair of spools for one dollar.

Among the features of the machine itself, the following are said to be the most prominent.

The type is instantly interchangeable. The carriage can be removed very easily, bringing away with it an unfinished piece of work. In the No. 3 the writing is absolutely in full sight. The machine is supplied with a simple form of carriage lock, but a release key is provided which enables a couple of further letters to be inserted to complete a word or make a convenient break. The line spacing is effected automatically with the return of the carriage. Manifolding and stencil cutting are executed with considerable ease and fineness. Should two keys be depressed simultaneously, neither will print, and the locking pin cannot enter the hole, and the type cannot, consequently, be brought down to meet the paper. No scale or pointer is necessary. Adjustable paper bands give any desired margin on any width paper ; paper of any thickness is taken. The writing line on the small carriage is eight inches long, and paper nine and a half inches wide can be fed into it.

The total number of parts does not exceed 500, the number of keys is twenty-eight, governing eighty-four characters. The key-tops are of celluloid, with inlaid characters. The machine is very compact and portable, and light in proportion to its size.

The Keystone.

The Keystone is a wheel machine. The working principle is very similar to that of the Hammond. The depression of a key-lever drives the type-wheel round until the letter to be printed comes into position, when the wheel is stopped by a swinging arm on the wheel-shaft engaging the depressed key-lever, this giving a positive stop. When the proper type is in printing position, the paper is driven against it by a hammer from behind. The alignment of the writing produced with the machine is, of course, beyond question, as is usually the case with wheel typewriters. Interchangeability of type is another advantage shared by the Keystone typewriter with other machines of the class.

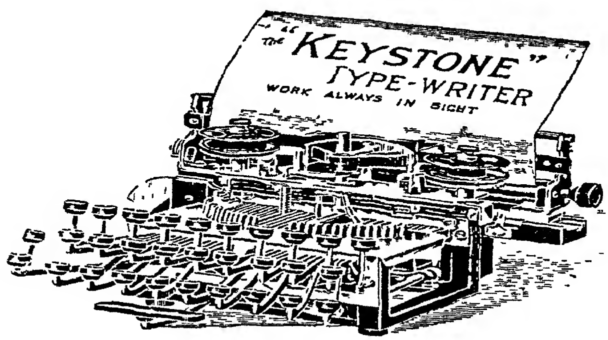


FIG 118

The manufacturers have adopted the standard key-board for the machine. It writes eighty-four characters, there being twenty-eight type-keys and two shift-keys. The inking device is a ribbon. The weight is $8\frac{3}{4}$ lbs.

The Munson Typewriter.

This machine was first submitted to the public in about the year 1892, and it has, since then, maintained its hold on a considerable section of the typewriter-using public. Its features are particularly the compactness of the key-board (there being thirty keys governing thrice that number of characters), the peculiar form of typewheel, its manifolding ability, and other points. With cover it weighs about 16 lbs. It is six inches high, twelve inches wide, and eleven inches from front to back. There being no carriage on top, the necessity for heavy castings is obviated, and there are very few parts, and such parts as are employed are

sufficiently strong to withstand any ordinary amount of wear and tear. The inking is effected by means of a ribbon one inch (or rather fifteen-sixteenths of an inch) wide, and this ribbon passes from the front spool right over the typewheel, down between the latter and the paper, which, however, it is prevented from smearing by means of a shield, and winds automatically on to the second wheel. There is not an automatic return, but the ribbon may be reversed readily by touching a small lever.

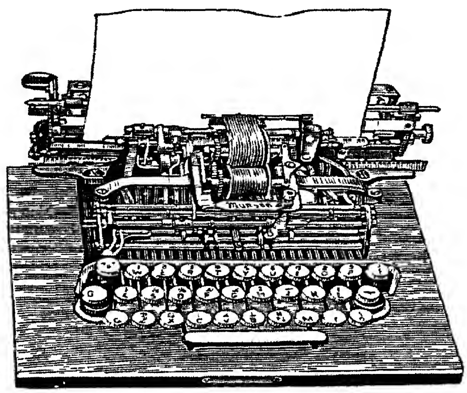


FIG 119

The typewheel consists of a hollow drum of steel, which is threaded on to a suitable shafting, and does not only revolve but also slides from right to left as may be required. This wheel weighs only one-fifth of an ounce, and of course since all letters move together, there is no risk of any letter ever getting out of true and correct alignment. The rotation of the wheel is performed by means of the shaft, which turns on a strong coned pivot at either end, and means are provided for taking up any wear in this direction, although as a matter of fact, it is claimed that wear in this respect, although in theory possible, never in fact takes place in practice. In the centre of the wheel is a slot or groove, and into this slot enters a guiding arm, which carries the wheel to the right or left as may be required. When a key is depressed, the wheel moves until it is stopped, by means of a check pin, which is set up by the movement of the lever, and it is locked against any side play by means of the corrugations at each end of the wheel. The characters appear on the wheel in nine straight lines, three lines being employed for each "case" (*i e.*, lower, upper, and figures) and the depression of the shift-keys automatically rotates the wheel one-third of a revolution either way. Hence in

striking any particular key the greatest distance which the wheel has to travel is very slight, a fact which makes largely for speed and certainty of operation.

When the required letter has been brought opposite to the printing point, a hammer strikes the paper from behind, and thus secures the imprint. This hammer is made, ordinarily, of hardened vulcanite, but for heavy manifolding or mimeographic work, a brass-hammer head can be substituted. By a peculiar arrangement of the carriage, the platen can be thrown back on to an erasing table to permit of any erasures being made.

FIG. 120

The machine was, after some time, amended and issued under the new name of the Chicago, and an improved model of the Chicago was afterwards submitted, in which the ribbon movement was considerably altered ; in place of the wide ribbon already mentioned a narrow one was used, but we have not met with many examples of this model.

The general movement and operation of the Munson was most highly interesting, since the depression of a key seemed to set the entire machine into life and movement. In its earlier form, the most objectionable feature about it was the touch, which was dull and unresponsive (very much like tapping a table top) but this was materially improved later on.

The Postal

This is an exceedingly compact and useful little machine which can turn out good work at a reasonable rate of speed, makes a good carbon copy and stencil, but which, as is

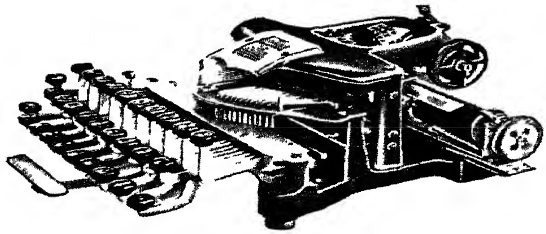


FIG. 121

almost invariably the case with typewheel machines, also creates a great deal of noise. The general form of the machine will be understood from the illustration. The keyboard follows the universal order, there being twenty-eight keys, which, by the operation of two shift-keys govern eighty-four characters. The type is engraved on a wheel, and resembles the wheel of the Blick and Commercial Visible, and other machines. The typewheel is connected with an index arm, the latter of which is set in motion by the depression of a key, but which is stopped by means of an index pin which is set up by the depression of the key. Thus the rotation of the typewheel is stopped by the same movement that sets it in motion. When the revolution of the wheel is stopped, it commences a descending motion. Attached to the typewheel is a sprocket-wheel, and a fixed blade enters this sprocket wheel as the latter approaches the printing point, and so secures certain alignment.

The ribbon movement is very simple, but requires to be reversed by hand when the end is reached. This reversal is, however, effected by a touch. Alterations, corrections, interlineations, etc., can be readily made, the ribbon can be thrown out of gear in a moment, the types can be cleaned without trouble, and the typewheels quickly changed. Save only the question of noise, we think most highly of this little machine.

Commercial Visible Typewriter.

This machine was placed on the market in London, the makers being the Commercial Visible Typewriters Co. of New York, the plural indicating their intention of producing various machines all of which were to have the writing in sight.

The instrument under notice was a typewheel machine, the wheel being practically similar to that of the Blickensderfer. There were two shift-keys, and the inking arrange-

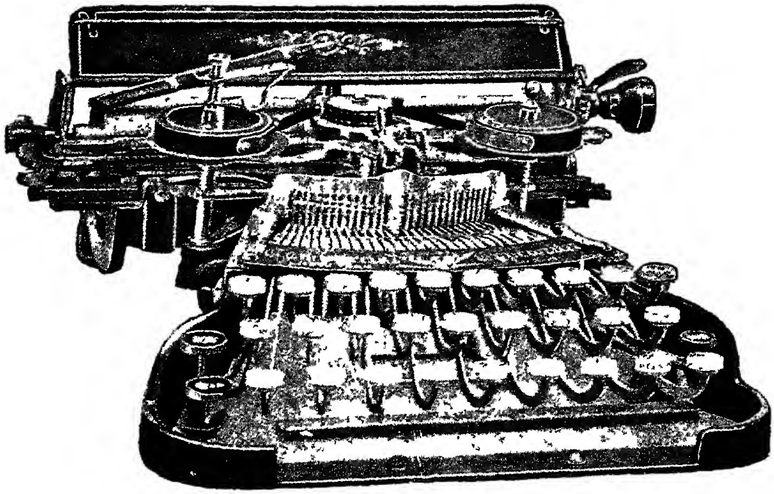


Fig 122

ment was a very narrow ribbon. The writing was (except when the figure shift was depressed) in full sight as it proceeded, letter by letter

The depression of a key caused the lever to tilt, and this forced round a driver arm, and so brought the selected letter opposite to the printing point. A hammer, similar to that on the Hammond, then forced the paper into contact

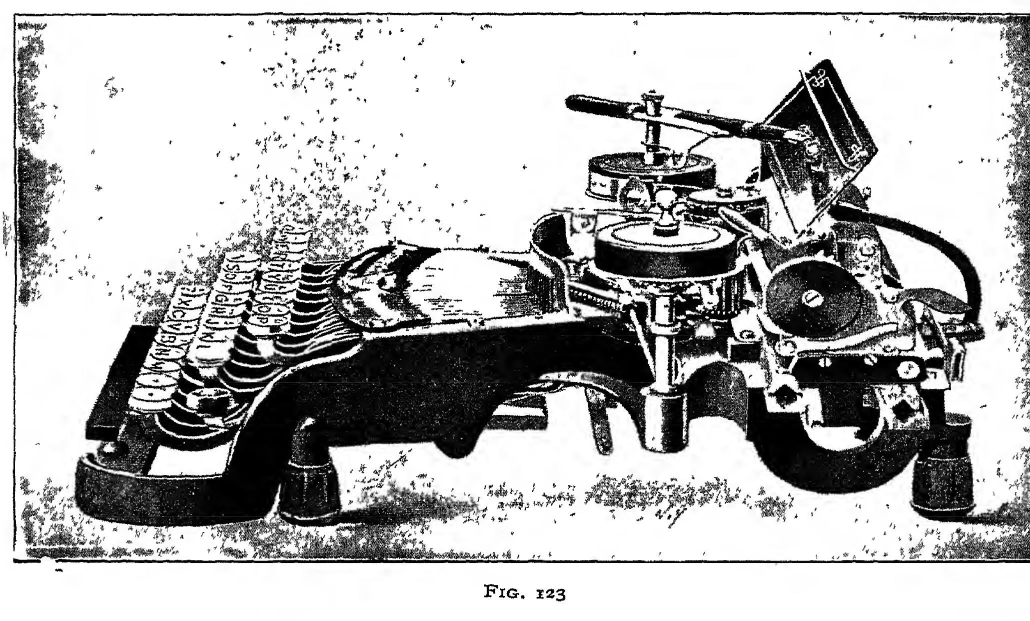


Fig. 123

with the ribbon, and thus effected the printing. As the Commercial Visible did not use a rubber impression strip, as in the Hammond, the head of the printing hammer was covered by a small rubber hood, which the makers called the platen. Hoods of varying degrees of hardness or softness were supplied (the price being only two cents each), and so good impressions could, it was claimed, be secured either on several thicknesses of hard paper, or a single thickness of tissue. Means were provided for no less than six degrees of line space. Many little features were provided for securing the greatest amount of facility in the use of the machine. Thus, a holder was fixed for carrying a stylographic pen or pencil for line ruling, there were line and letter position indicators, the type was interchangeable, the whole keyboard could be removed easily, the carriage ran on ball bearings at a minimum of tension, means were provided for taking up wear of the type-levers, and so on. There was an elevated scale, for use in tabular work, no bell was provided, as the writing was so very visible that none was needed, and so on. The carriage could be locked so that vertical writing or columns of ditto marks („) executed, the ribbon spool shafts were extended so that four ribbons of varying colours could be carried at one time, the margin could be released for insertion of marginal notes, there was a keyboard lock, it permitted of writing being executed, under certain conditions, in bound books, and in fact, had it not been for the fact that the machine would not write at any speed, and that the revolution of the typewheel shaft was not reliable, but varied according to the intensity of the blow (so that after a little practice one could strike two or more letters by the depression of one key), and that owing to the peculiar nature of the feed, it was impossible to feed in long paper, or several thicknesses with certainty or regularity, the Commercial Visible would have been a perfect machine. Moreover, although personally we have made many trials to cut stencils or do manifolding work on it, we have never once succeeded. From this it will be seen that the machine failed to carry out its promises, and probably for this reason it soon lost grip. No machine has ever, to our mind, possessed more graceful lines, very few have had such ambitious aims, fewer have had more good points, but certainly no machine ever proved more disappointing to us in actual use.

The Moya Typewriter.

This is a small typewheel machine, of English invention, made at Leicester. It works with a double shift-key, and the order of its keyboard follows the universal arrangement.

It is particularly interesting by reason of the incorporation of a device entirely new in typewriter construction, which renders the use of twirler arms and check-pins quite unnecessary, and at the same time so simplifies the whole of the mechanism that the machine can be sold at the sum of five guineas, exactly one quarter of the price for which typewriters are usually sold. On examination of the illustration, it will be seen that the type is mounted

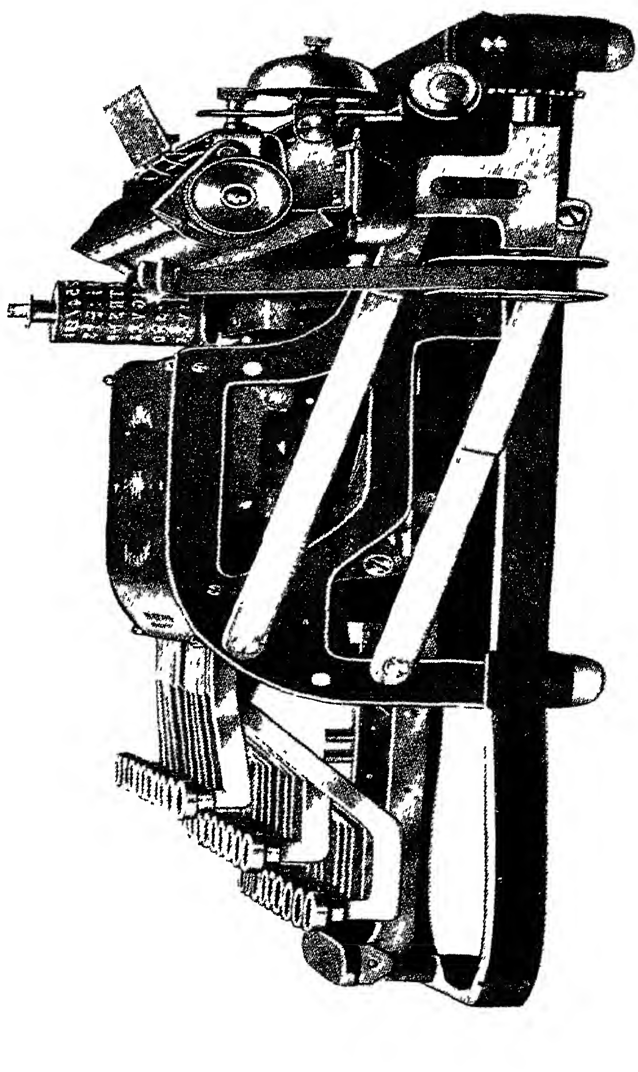


FIG. 124

on a small wheel in six rows, two rows each being allotted to the lower case, upper case, and figures. This wheel is mounted on an upright post, which also supports a cam. Working freely in this is a pin, and on the depression of a key, the pin is forced down to a greater or less extent, varying according to the position of the selected letter upon the typewheel. When the pin can travel no farther an automatic impression is made. On the key being released, the driving pin is forced back again to the starting point, ready for the next letter.

The inking is effected by means of a ribbon working on two spools, which are readily interchanged for others or to replace a worn out ribbon with another.

The lower-case letters are on the lower row on the wheel, and the depression of the shift-key does not effect the wheel, as in other machines, but by means of the long levers shown in the illustration, raises the whole of the carriage one or two steps as may be required. This renders the movement in order to bring the fingers into play rather deep, but this does not, for the class of user to whom the Moya particularly appeals, constitute any defect, although operators of other machines might find it a little awkward. It manifolds well, and will cut a good stencil. The machine is fully equipped with scale bar, warning bell, marginal stops, and so on, and presents a remarkably neat appearance. Its weight is but small, and it is, in consequence, very portable.

CHAPTER VII.

SPECIAL MACHINES AND APPLIANCES.

(1) Electrical Typewriters.

VERY many patents have been issued for electrically driven writing machines. Many of these have been fantastic in the extreme, but one or two have been capable of turning out really good work. The object of the introduction of electricity has been to secure a more, even impression, greater speed, and consequently better work and more of it. The following instruments appear to be the most meritorious machines of this class.

The Cahill. This machine was placed upon the market in America about 1899, and after a career of a few years closed down pending developments.

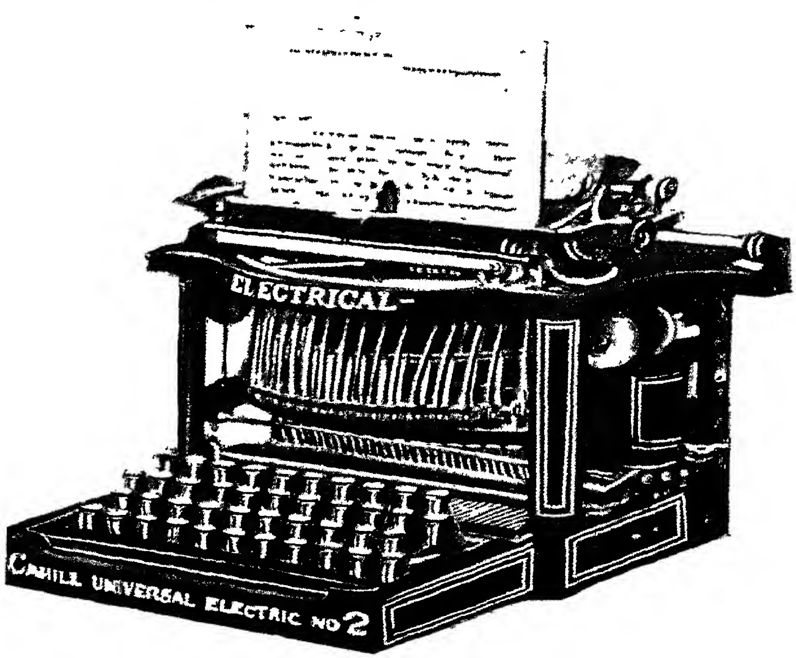


Fig. 125

As will be seen by the illustration, it is based on the model of the No. 2 Remington, the paper feed and the ribbon mechanism being practically identical, and its general outlines also resembled that machine.

In its construction, an electro-magnet is used to impel the type-bars in their movement, and the same device also operates the spacing mechanism and other moving parts.

The finger of the operator is merely required to touch the key corresponding to the letter desired to be imprinted, and the electric circuit is thereupon completed, and the type strikes the paper with a force which is absolutely uniform. Increase of force in no way increases the weight of the blow, but a rheostat is attached to the instrument, by means of which greater current is released, and manifolding can be effected.

Those who have used the machine declare it to be a marvel of lightness and speed, and these points, combined with its automatic and simultaneous spacing, caused many to regard it as the perfect machine at last.

It is to be hoped that Dr. Thaddeus Cahill may yet live to see his invention crowned with the success which its many good points seem to indicate it merits.

Faber's Electrograph. This machine was the production of Dr. Faber of Berlin, and was invented about 1900. It contained a keyboard, similar to other machines, with eighty keys and the usual space-bar. The platen was a mounted platform, *à la planchette*, travelling right to left and from top to bottom of the baseboard, and the paper was laid flat thereon against guides and held by a clip. The types were suspended above the platen, and were arranged somewhat after the fashion of the Hansen writing ball. On a key being touched, an electric current was transmitted to the piston carrying the corresponding letter, and the impression made. The writing was wholly visible.

Six elements were sufficient to secure a good imprint, and the switching on of further power added such force as was required to increase the blow to any desired degree, and an almost indefinite number of carbon copies thus obtained.

Ennis's Electrical Typewriter. This machine is the invention of Mr. G. H. Ennis of Troy, but we do not know that it has yet found its way to the market.

The invention contemplates the current doing all the work involved, when once the mechanism is set in motion, by a slight depression of the key. There is a lever under

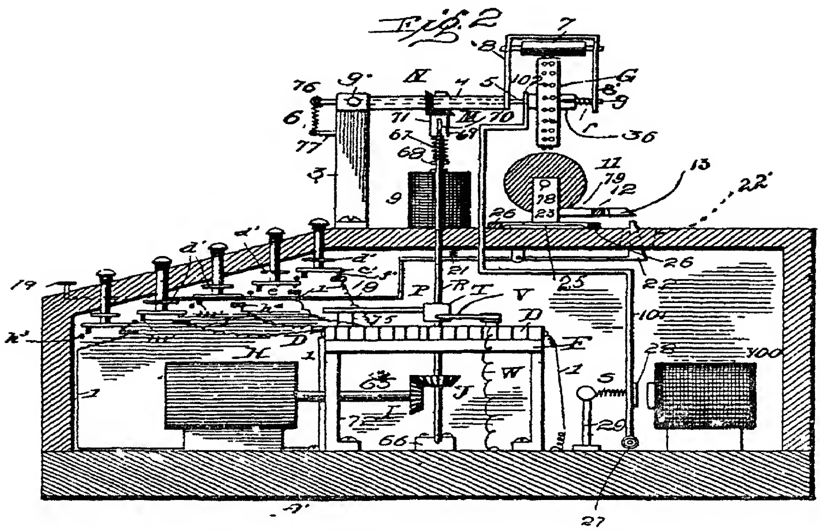


FIG 126—SECTION OF THE ENNIS ELECTRIC TYPEWRITER.

the keyboard, having dependent therefrom a pin, just out of contact with a shoulder on a roller. On depression of a key, the roller turns until it is held in check by the pin. The revolution of the roller serves to rotate the type-wheel until contact of pin and shoulder brings both the roller and the type-wheel to a standstill. A second circuit from a pair of electro magnets at the rear of the roller is then closed, and the type-wheel brought down to the platen with sufficient force to cause the imprint. Inking is effected by small ink rolls which press against the face of the wheel as it revolves. The release of the key breaks the circuit, and a spring causes all parts to resume their normal position.

Several variations and improvements on the original patents have been made, and the sectional view herewith shows one of the latest forms which the machine has assumed.

Blickensderfer-Electric This is the only electrical machine which has, so far, reached the English market. It is the invention of Mr. G C. Blickensderfer, whose earlier instruments it in no way displaces, and which have already been exhibited (see p. 145).

The Blick-electric was only placed on the market after the most elaborate tests, and represents almost the last word in power driven machines of the type-wheel class.

Briefly speaking, the theory upon which the Electric Blick is constructed is this. There is attached to the machine, a small electric motor, of about one-fortieth horse power. This motor is operated by connection with

an ordinary electric light socket, and when switched on, is continually running, and has the tendency to revolve the shaft carrying the type-wheel, but is prevented from doing so by means of a dog or clutch. When a key is depressed (we use this word in this clause, but shall refer to it again later on), this clutch is released, the type-wheel revolves until it is stopped by means provided, and then goes forward and strikes the paper. The impact of type-wheel and paper complete, the wheel resumes its normal position, and the carriage moves. The great error into which

Fig 127.—The Blick Electric

critics fall is in assuming that the type-wheel is revolved by making an electric contact, and in the further assumption that a point of contact must exist for every type or lever, whereas, in theory and in fact, there is no contact at all, the practical effect being that the striking of a key breaks a contact, and permits the wheel to revolve.

The illustration will show just what the electric machine is like. From this it will be seen that there is no change of a radical nature about it. Everything is in its usual position, and as the Electric has the Universal or Standard key-board, the operator of any other machine can turn immediately to it. It is in the details that the great advantages are to be found.

We referred just now to the "depression" of keys. Properly speaking the keys are not depressed, at any rate in the usual sense of the word. They are just tilted, ever so slightly, not more than one-eighth or one-tenth of an inch. Directly this distance is covered, a slight and almost imperceptible "click" is heard, and behold, the letter is printed. The click is the sign of the breaking of the contact which the clutch before mentioned has made, and in a flash, the result is made upon the paper.

Now, when the key is tilted, the impression is made automatically. The lightest and most fairy-like touch will produce just the same quality of impression as would a sledge hammer. It is waste of energy to strike hard. The operator does not, in fact, strike at all, but merely indicates by a touch the character wanted, and it is printed.

Light touch, therefore, does its work. The machine always exerts an even touch, and the impression is regular. One letter is not faint and the next blurred The writing is as even as though from a printing press.

If, for the purpose of making a number of carbon copies, it is thought a heavier blow is required, the machine, by the movement of a lever, will throw on that extra power. The machine does it. The operator indicates what he wants the machine to do, *and the machine does it!* Up to fifteen or more carbons can be turned out at one operation, and no more effort is required on the part of the operator than if one copy only were wanted.

Then there are two keys on the right of the keyboard, marked "R" and "L" respectively. Touch the one marked "L", and the carriage returns automatically to the commencement of a new line, shifting the paper as it does so. Touch the "R" key, and the carriage travels slowly to the right, enabling any margin to be made. Work the two fingers alternately on these keys, and the carriage sways to and fro like a thing possessed, but always under the most perfect control. The practical effect of this is that the writing proceeds from the "Dear Sir" to the "Yours truly," without raising the hand from the keyboard. If the machine under notice contained no further novelty than these two keys, the makers would be fully justified in placing it on the market, on its own merits, in competition with all others.

Then the carriages are interchangeable. Lift a catch and the foolscap carriage will slide off, and a brief one put on. Same machine in all cases, but with a power of carrying any carriage, whatever its length. We understand the

New York Central Railway have one working with a thirty-six inch carriage. The convenience of this is too great to need a single word of explanation.

The machine provides for back spacing, tabulating, and ruling devices, and has a large number of other good points.

(2) Book Typewriters.

Many attempts have been made to produce a typewriter which shall permit of the writing being performed in bound books, and as we have already pointed out, the French machine of Progin was so constructed that this operation would not have been difficult, even in those early days. Details of other inventions in this direction will also be found in the Supplemental notes later on in this volume, but it was not until Messrs. Elliott and Hatch completed their machine that a really practical book typewriter existed. The great line of demarcation was in providing for a stationary platen and a moveable machine, instead of a moveable platen and a stationary machine. The manner in which this was carried out was simple.

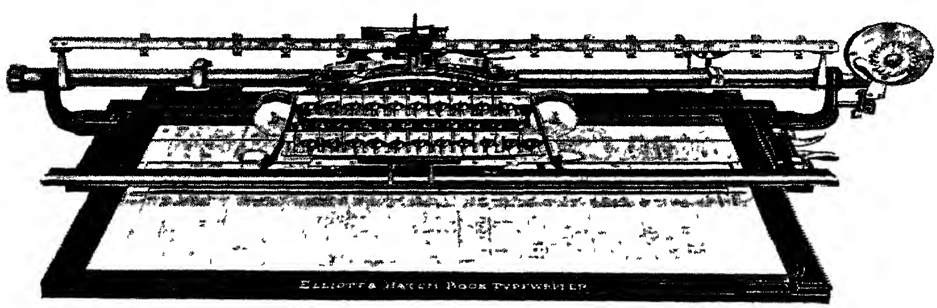


Fig. 128

In appearance the Elliott and Hatch typewriter is flat, it being only about six inches high. The keyboard, which usually is the first to catch the eye of an operator, corresponds to that adopted by the leading typewriter companies of the day, and is known as the Universal. There are forty-four celluloid keys, which, together, represent eighty-eight characters. The type-basket is circular, is in full view, and is easily accessible at all times. Each type, in striking, has a downward movement, and is brought back again by a long and finely tempered spring attached to the

type-bar at its bearing. The fingers of the keys are steel, and are sufficiently heavy to insure firm and positive depression, and yet are light enough to render their action perfectly free and elastic.

Governing the operation of the keys, an especially nice device is that for making capital or upper case letters. And it should be said here that the owners of this machine are the first to solve the problem of how to obtain, by means of a shift key or otherwise, both upper and lower case letters on a book typewriter. At the left side of the keyboard is a key marked "Caps." When that is struck a metal disc, located in the top and centre of the type-basket, and about the size of a fifty-cent piece, is depressed. Each type that is struck while the disc is in that position, comes in contact with it, and, with no perceptible check to the movement of the type-bar, the lower-case letter is temporarily displaced and an upper-case letter substituted. When the key is released, the lower and upper case characters resume their former places automatically. The change is made possible by a decidedly clever arrangement of the type at the end of each bar, which, at the option of the operator, permits either an upper or lower case character to strike the paper. The mechanism is so simple and perfect, that the amount of friction caused by changing from one case to the other is almost infinitesimal. The type is inked by a ribbon, the movement of which is automatic and simple.

A striking peculiarity of this bookwriter is to be found in the following circumstance: Instead of the paper moving to accommodate the position of the type, the type themselves move to suit the position of the paper. In other words, the keyboard and type-basket of the machine are constantly travelling from left to right while the keys are being manipulated, and at the end of a line are drawn back for another trip across the page. Yet, so skillfully have the inventor and mechanic done their work, the muscular force necessary to return the carriage is surprisingly slight.

An excellent auxiliary to the bookwriter is a contrivance at the back, which is operated by a thumb-screw, and is used for regulating the height of the machine from the table. To accommodate books of varying thickness, the typewriter proper is raised or lowered until it is on a plane with the page to be written on, and by employing the device referred to, that task is performed in a jiffy, and with scarcely any exertion. When once set, the plane regulator

may not need to be readjusted for a whole day, or, perhaps a week, the necessity to change it depending entirely upon the size of the book and the progress of the operator.

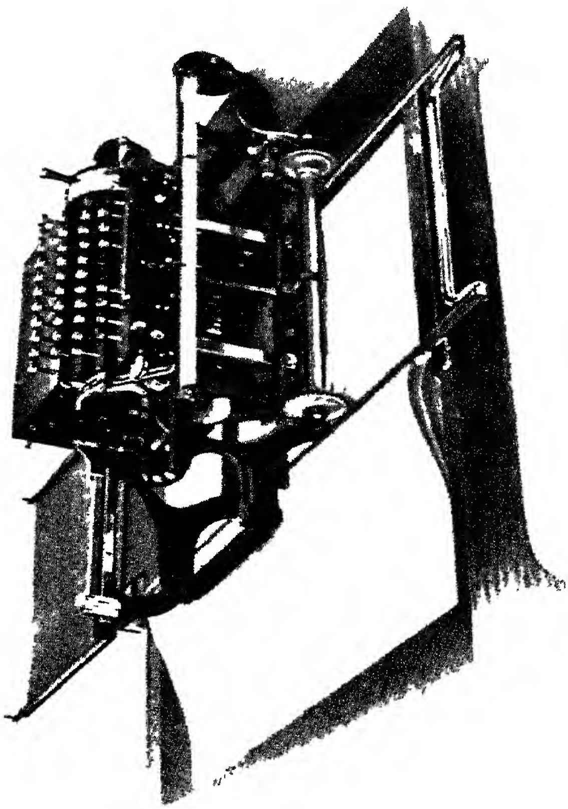


Fig 129

After the Elliott & Hatch machine had continued in use for some time, a new machine, called the Fisher was submitted. This machine as will be seen by the illustration, resembled a Bar-Lock turned upside down, with the keyboard put on top. This, also, worked by means of a shift key and ribbon, but owing to the open front, the writing was at all times visible. The power of this machine was very greatly in excess of that previously mentioned and the result was that the two companies soon joined forces, and became known as the Elliott-Fisher Company.

With wonderful thoroughness and skill, Mr. Robert J. Fisher, says a writer, brought to perfection his book

typewriter having visible writing, universal keyboard, capable of operating on the pages of bound books of any size or thickness, and weighing but fourteen pounds.

The principle of the machine reverses that adopted in letter writers—the book remains stationary; only the typewriter moves across the page at every touch of the key, down the page on two slender rails by touching a lever.

If the Fisher machine were simply a book typewriter, it would probably be considered a notable invention; but besides being a perfect book typewriter, it will do all the work that is accomplished by any letter typewriter, and possesses points of advantage even as a letter writer that are of much value One of these is that it permits letter writing being done direct on the pages of a letter impression book, with the use of a carbon sheet, saving the time necessary where the letter-press is resorted to, insuring legible instead of blurred copies, and avoiding danger of loss of loose sheets where the loose carbon sheet system is used. Its use as a letter writer, however, is not confined to its operating in books, for it will write as easily on loose sheets as any other machine.

An immense field of usefulness is also opened out for the Fisher, in consequence of its power as an invoicing and day-book entry machine. The great power of manifolding which the firm platen yields, permits of many copies being made simultaneously, so that on receipt of an order a single operation will permit of an acknowledgment being typed, and at the same time all other necessary forms for manufacturing, packing, shipping, invoices, etc., but this branch of the subject lies somewhat beyond our present scope.

The Gorin Tabulator, to which reference should be made, is an exceedingly simple and ingenious device whereby the carriage may be made to travel rapidly to any desired place according to a pre-arranged plan. It consists practically of three parts, namely the keys, the connecting rods, and the rear portion which forms the tabular proper. This latter is a notched scale-bar, attached to the rear of the machine. This scale-bar is marked in similar manner to the usual scale-bar, and is provided with a number (generally four, but more may be used) of little stops, which may be placed in such position as may be desired. Then by merely pressing the key or plunger to the left of the keys, the ordinary spacing mechanism is thrown out of order, and the carriage flies along until it is arrested by

the stop before mentioned. When columns are arranged so as to commence at even spaces throughout the page, the method is definite, sure, and simple. In such cases as

London	Glasgow	Swansea	Paris
Mannheim	Eberbach	Dordrect	Boston

and so on, all one has to do is to decide exactly where the columns are to commence, place the stops there, and after writing the first word, press the plunger to the left, and the next moment the carriage is in a position to commence the second word, without recourse to the space-bar.

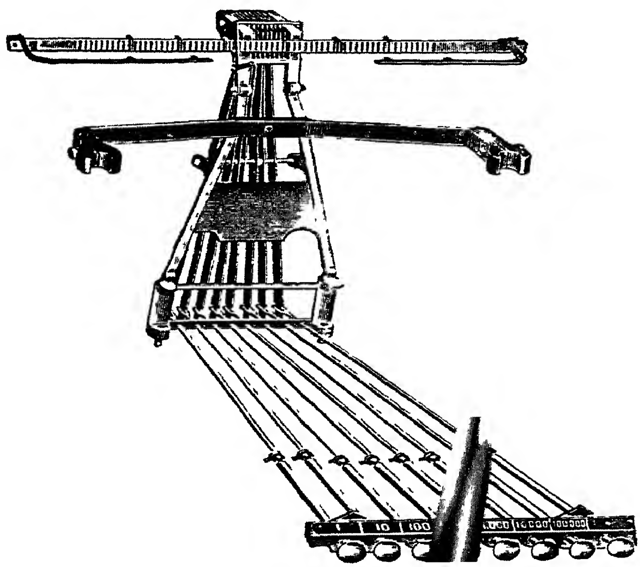


FIG. 130

But in executing irregular col[redacted], as of money and so on, the columns do not always [redacted]mmence at the same place. The unit is therefore ta[redacted]as on the right hand side, and each succeeding plunge[redacted]ter the first, stops the carriage one space before that [redacted]h the stop is fixed. Thus,

For I, we touch the fi[redacted]ger.
,, II, we touch the se[redacted]lunger.
,, III, we touch the th[redacted]nger, and so on.

It will, however, be clear t[redacted]ere the carriage moves over a number of spaces, the[redacted]d shock must be very

great, and the noise is very considerably increased, so much so, in fact, that it is found, by some persons, to be a barrier to the use of the Tabulator at all.

Modern machines, particularly those of the Front-strike variety, are all fitted with a Tabulator as part of the machine, without necessitating an extra outlay of four or five pounds as with earlier devices. These are, for the most part, capable only of being set to fixed points, so that any irregularity which may be desired must be obtained by the depression of the space-bar. In these machines the unit is always regarded as on the left side, so that if we desire a column of figures, we can set the stop for say, 1,000 and depress the space-bar once or twice when hundreds or tens only are required And as the makers point out, the Tabulator on some machines is so constructed, that the travel and noise of the tabulator in under entire control of the operator all the time, and he can permit the carriage to travel quickly and noisily, or quietly and slowly, as he may desire.

Many attempts have been made to aid the operator in performing tabulated work, without the assistance of a complete tabulating attachment. One of the most meritorious

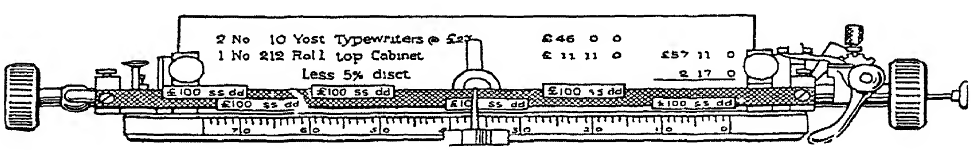


FIG. 131

of these was a device called the Columnator, introduced by the Yost Typewriter Co., which consisted of a supplementary scale bar affixed to the front of the machine This bar was made to carry a number of moveable indicators, which were set at the places at which columns were desired to commence. The operator then tapped the space-bar until the front pointer on the carriage, indicated that it had reached the place of the moveable indicator, when the required letters or figures would be typed. In connection with this device, the No. 10 Yost could also be fitted with a modified form of tabulator called a Jumper, which passed from fixed point to fixed point by the mere depression of the margin release key. Various other makers have devised moveable stops to be fixed to the scale or other parts of many machines, all intended to assist in the correct and easy manipulation of display work. One, patented by

Mr. Cockrom, was a transparent slip of celluloid or other material, upon which any notanda could be written, and the same fixed to the front scale easily, but we have not heard whether it has attained any degree of success. As a rule, operators in England are very neglectful of any supplementary aids to the performance of their work, and of course, it is hardly to the interest of any manufacturing Company to "boom" any device which is not their own.

Several patents have also been issued for word counters. As a rule, these devices act by the depression of the space-bar, since it is considered that the only need to depress this will be between words. These word counters act upon the principle of the cyclometer, and register words with fair accuracy, but it will be seen that if the practice of making two spaces after colons, and three after periods is adapted, the word counter will utterly fail, to say nothing of what might happen when spacing out is required, or the indentation of paragraphs is executed.

We may also mention here that several devices have been invented in order to indicate the proximity of the foot paper. One of the most ingenious of these was a strip of tin-foil attached to the platen. A similar slip was attached to the feed roll, and both were connected with a small battery at the rear of the machine. So long as the paper separated the two rolls, nothing happened, but when the lower edge passed the feed roll, the tin-foil was exposed and came into contact with the corresponding slip on the platen. A complete electric circuit was thus set up, which caused a small bell to ring. The cost of the whole attachment was to be three or four guineas, but the entire object of this device has since been achieved by the simple plan of cutting a few niches or slots in the lower part of the framework of the carriage, which permits the approaching end of the paper to be immediately seen These slots are shown very clearly in the illustration of the carriage of the Oliver Typewriter in an earlier chapter.

In order to compete, it may be, with the flat platen machines, many of the so called standard machines have been equipped with special devices whereby most of the functions of the flat platen machines may be assumed by older makes. Thus, in the case of the Yost typewriter, by means of a specially fitted annular scale on the platen, and an additional paper table, the loose leaf of a day-book can be fed into the machine, with an invoice on top, and the invoice and day-book entry executed simultaneously. The Yost, in order to assist in this work, also provides a

ribbon attachment, so that credits may be written in in red or other colour to that of the body of the matter. The Smith Premier and the Remington both have what they term Billing machines (why not use the proper English expression of Invoicing ?) in which, by means of the Gorin Tabulator, a Day-book device, and a bi-coloured ribbon, similar objects are sought. The Fox, also, makes a special feature of the Billing machine, specially adapted to this class of work.

The two-coloured ribbon is a very great convenience in many special directions, and the Smith-Premier, which employs a ribbon unusually wide, has even placed a tri-coloured ribbon on the market which permits of red, purple copying, and black record work, all being executed from the same machine, wherefore they consider themselves justified in referring to their machine as being equal to " three machines in one." But save only in exceptional instances, the use of these vari-coloured ribbons seems to be somewhat limited, and of course somewhat extravagant, since one portion, say the copying ink portion of the ribbon, is bound to be worn out and exhausted before the others have been even slightly used, so that practically speaking, a tri-chrome ribbon lasts only one-third the usual time.

Marriott Book Typewriter. Mr. J. H. W Marriott, of Washington has invented a book and billing machine, which contains a number of novel and valuable features.

He recently gave an exhibition of it before some newspaper men, and they were quite enthusiastic regarding the merits of his invention.

All book and billing machines now on the market use what is known as revolving type, in order to obtain capital letters. This makes the machine hard to keep in alignment and difficult to clean. Mr. Marriott uses an entirely new style of type-bar, doing away with the necessity of revolving type to make capitals Any width of paper or card-board can be used in the machine, as the carriage rails or ways do not hold the paper, the platens being independent of the carriage tracks.

A valuable feature also is the moveable platen, as the carriage can be locked in one position and the platen spaced backward line by line ; this obviates the necessity for the operator stretching her arms when the machine is in position at the top of the sheet, and will be appreciated by all users of such machines. The keyboard is placed low, directly in front and in the most natural operating position.

The machine can be used equally as well to write in books as on flat surfaces, and also for letters. It has a small number of parts, very few springs, and whilst constructed on the most improved mechanical principles, is exceedingly simple in every way.

(2) Stenographic Machines.

In the view of a great many people, a time will come sooner or later, when pen or pencil written shorthand will be entirely replaced by mechanical stenography. We do not take any sides in this controversy, as, for one thing, the whole subject is far too wide to permit of its being discussed in the following pages. But the following particulars of a few of the more notable applications of the principle of the writing machine to stenographic purposes, will, perhaps, enable the reader to form a fair idea of the present position of this branch of the subject.

Gonod, in 1827, having observed the facility and dexterity attained by pianists in the execution of the most difficult music, and the fact that a great number of keys could be found and depressed in a limited time, devised a machine upon the general principles of the piano. He arranged a keyboard, capable of being operated according to a definite scheme, in order to spell the words. The signs he used were two points, one being round and the other lozenge-shape, and by the combination of these signs was able to construct a complete alphabet.

In 1830, an Italian artist named Galli devised a mechanical tachygrapher, the keys of which corresponded to the letters of the alphabet, and were arranged in two concentric circles. The keys apparently struck down towards the paper, after the plan of the Hansen Schreibkugel. The paper was coiled on a drum, which apparently revolved between the letters. As the characters were ordinary roman letters, transcription was thought to be unnecessary.

In 1869, M. Bryois devised a keyboard machine, which was intended to execute its work in such a way that the shorthand it produced should be readable all over the world, and a little later, M. Danel-Duplan published a work explaining a system of Stenotype, which however, did not advance the art in any way.

In 1883, a civil engineer of Leipzig, named Amadeo Gentilli, invented a little insturment for the purpose of reproducing the sounds of speech. He called it the Glossographe.

All this time, however, a very ingenious instrument called the Michela was being developed. The first public exhibition of this machine was at the Palais Brera, at Milan, in 1863, and after various other appearances, it was in consequence of various favourable reports, adopted in 1880 by the Italian Senate for the recording of the debates in that assembly.

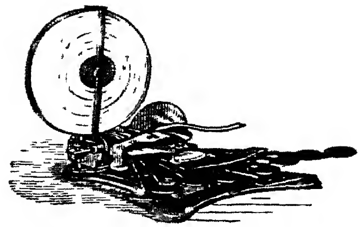
The machine bears some resemblance to a portable harmonium. There is a keyboard, having on each side six white and four black keys, which print a series of marks . : U / ∩ ⊥ in such combinations as will enable words to be spelled legibly and readily. The claims made for the machine are :—

1. The maximum of speed.
2. Precision and uniformity of the signs.
3. Great facility in transcription.
4. Very limited use of abbreviations.
5. Conservation of physical force, hence absence of fatigue in operation.
6. Since the operator has not to fix his eyes on the writing, he can follow the movements of the speaker or audience.
7. The system is readily adaptable to other languages.

Finally, M. Cassagues devised a system of stenotelegraphy, using " a sort of " typewriter, by which messages were successfully sent over a distance of 929 kilometres, at rates varying from 12,000 to 24,000 words per hour, but this is perhaps a little wide of the present subject.

The Stenograph In this machine we have a flat base with nine keys, the centre one projecting a little, and being manipulated by the two thumbs. The remaining keys are arranged four on each side and are coupled in twos, the two outer being joined together, and so on towards the centre pair. There are thus, in reality, only five keys to the machine to be worked by the fingers and thumbs of both hands. The printing is done on a continuous paper ribbon, winding off a reel, the impress being made through the medium of an inked ribbon by five little markers in the form of - - - - -

By striking the thumb-key the mark is produced on the left edge of the paper for the letter d ; the second key produces a mark between the left edge and the middle of the ribbon for n ; the third key makes an impress in the middle



The "Stenograph."

Fig. 132

of the ribbon for r; and so on. Mr. Bartholomew (the inventor) writes phonetically, writing all consonants, initials and final vowels, omitting such vowels as are not essentially necessary for legibility. It may be well to let Mr Bartholomew speak for himself as to how he manages the spelling. He says, "Any stenographer can easily determine what letter of a word it is necessary to write. In any arrangement I represent a word with each letter, and some few letters represent two words of frequent occurrence, in much the same way as they are used in shorthand, except I cannot write a letter above the line for one word and on the line for another. I have probably thirty word signs represented by the thirty-seven letters I make use of, and perhaps fifty other words are represented by less than the full number of consonants, h-w for when and h-t for what, and so on. There are something less than 100 in all. Aside from these, in writing vowels, I spell out the consonants, of course, and I also write final vowels. I write the initial vowel where it is necessary for legibility or to distinguish words, as between attend and tend, apart and part, and so on. Writing the final vowel distinguishes between such words as part and party, and so on. Words that are alike in the consonants I distinguish by the vowels, as I have no positions to use in that way. For instance I write d-n for done, and d-i-n for dine or din, and if necessary to distinguish them I add the vowel on, as in common spelling, either the final vowel or in any other way."

The Anderson Shorthand Typewriter. This is a small typewriter designed especially for rapid work, having but a limited number of keys, arranged to be covered simultaneously by the fingers of both hands, and enabling the operator to make good and rapid stenographic report on the typewriter itself. As will be seen, the characters are

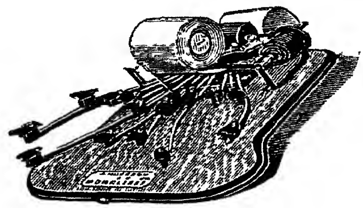


Fig. 133

printed transversely across a continuous strip of paper, a word being printed at one stroke in plain English letters. An ordinary typewriter is handicapped in the matter of speed by the fact that only one key can be struck and only one finger used at a time—nine fingers being always idle. By this invention the keyboard is so constructed that all the keys can be operated simultaneously. The machine has only sixteen printing keys, arranged in pairs so that each finger can operate two; hence, sixteen characters can be printed at each stroke if needed; and by the use of a pair of shift keys at each side of the keyboard, the capacity of each printing key is increased, just as the use of a shift key on the ordinary typewriter enables the operator to print either a small letter or a capital by using or not using the shift. On the Anderson machine, however, the shift keys and the printing keys are struck together and the hands remain substantially in one position, simply moving up and down, each finger above the pair of keys assigned to it, instead of darting here and there over a large keyboard. One downward movement of the hands prints the word, and as soon as they are lifted the machine automatically shifts the paper forward ready for the next word. It is claimed that this machine can be operated at the rate of 100 words a minute after six weeks' practice, and that its possibilities in the way of speed are greater than those of stenography; "that it will not only save the time now spent in learning shorthand, but will do away with errors and illegible notes, and that in courts and large mercantile establishments, a corps of typewriter copyists can be kept busy transcribing while a single Anderson operator is taking."

But the prophecy has not yet commenced to mature!

The Stenotyper. The inventor of the Stenotyper, (John Franklin Hardy) was a skilled Graham phonographer whose inclinations led him to explore the well-known Cross System of Eclectic Shorthand. The orthographic basis of this method governed his future actions to a considerable extent. Mr. Hardy was also a professional telegraphist, of vast experience in the southern and western parts of the States, and he subsequently became a well-known typewriter man, whose doings and movements find record in professional papers of the later eighties and earlier nineties. His acquaintance with the winged art had led him to conceive the idea of a shorthand machine, his experience of the Morse instrument directed his thoughts towards that instrument as being a possible solution of the difficulty, and his intimate knowledge of the typewriter, past and then present, showed him how to work out his problem. No man had a more intimate acquaintance with the object of every part of the typewriter. No man had a keener appreciation of the effect of a change or the introduction of a new device—and it is safe to say that no man, other than he, could have devised the Stenotyper

The Stenotyper is a small machine, measuring about 8 in. by 7 in. and about 4 in. high. Its total weight is only three pounds or thereabouts. As will be seen from the illustration, it looks somewhat like a miniature typewriter, but there is no moving carriage It is the ability to write a line, quite as long as that in any ordinary note book, and then, when the line is finished, to commence another automatically, without stop, pause, or hindrance, and, indeed, without even a knowledge of the fact, that gives the Stenotyper its marvellous powers.

There are but six keys on the Stenotyper. First, there is the key in front, and above that four others. The illustration may be thought to show seven, but the explanation is that the keys on the right half of the bank are duplicates of those on the left half. The long key on the top bank completes the keyboard. The object of the peculiar arrangement is, to permit the hands to work alternately. Thus, if a character is struck with the right hand, the next is written with the left hand, and so on.

The Stenotyper does not print ordinary letters Each key prints a dot or dash, and one key, or the whole keyboard, may be depressed at once. It takes no more time, and involves no greater effort, to imprint the most complex-looking sign than it does the simplest dash or dot. And,

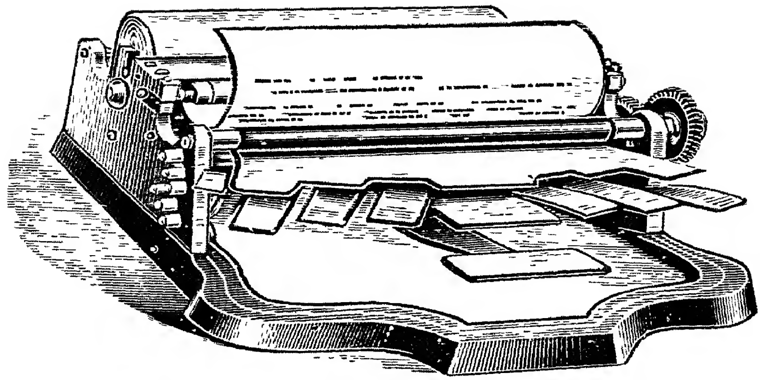


FIG 134

as the characters all occupy the same degree of spacing, there can be no overcrowding or letter written in undue proximity.

The combination of the dots and dashes will permit of no less than sixty-three groups or forms, and, after the letters of the alphabet have been provided with suitable signs, numerous digraphs and trigraphs are accommodated, so that, by the mere depression of the respective keys, quite an abbreviated method of writing is at hand, without the introduction of word signs or other contractions. But the Stenotypic alphabet permits of a vast amount of compression. There being no risk of misreading through thin strokes being made thick, or this half length being made too long, or that sign off the line when it should be on, it follows that whatever is written is absolute. Hence, it is claimed far greater freedom can be taken with the powers assigned to each group of dots or dashes than is, or ever will be, possible in pencilled shorthand At least two business concerns have been interested in the propagation of the Stenotyper in this country, but for some reason neither has had any prolonged business career.

The Stenophile. This is another effort to produce a shorthand typewriter, but it appears to suffer from the defects common to most of its predecessors, since the writing is effected on a narrow paper tape It is the invention of a Mr. Bivort, and some operators are *said* to have operated it to the extent of 320 words per minute. As

will be seen, it consists of a keyboard having twenty keys, ten on each side of the central space-bar, arranged in fives in each of the two banks. Moreover, there is a shift-key, which varies the position of the paper in order to print figures and signs. Several keys may be depressed at once, and as a rule, little more than a single effort is necessary to print any word

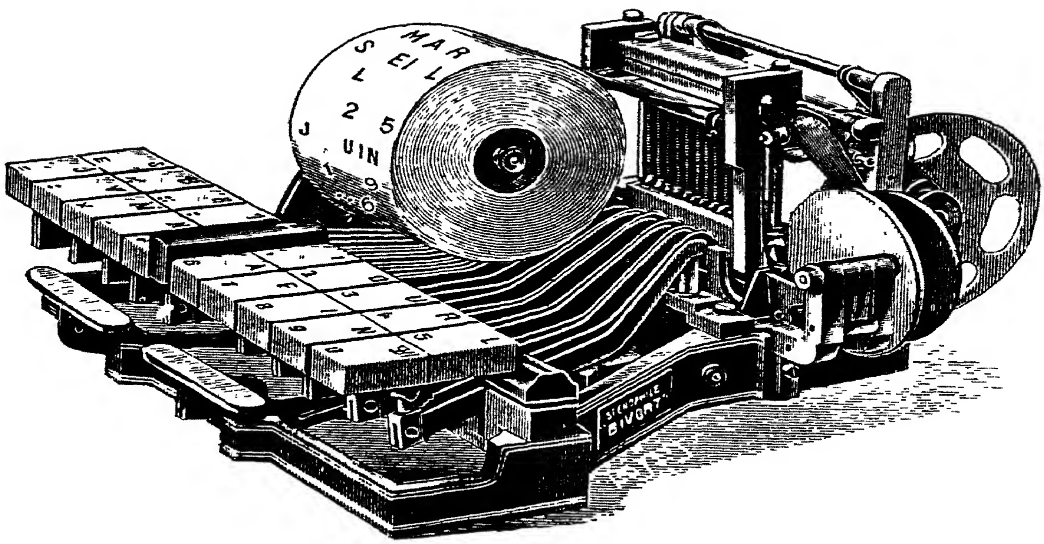


Fig 135

The printing is by ordinary characters instead of arbitrary signs, but in the case of phonetic pairs, such as FV SZ KG, etc., the sign printed is a new one, formed of a combination of its primitives, and such sign stands for either one or the other character. Life, therefore, is written the same as live, and so on. In French shorthand, it is found that this dual significance does not materially affect the question of legibility, but the efforts of earlier shorthand inventors in this country, who essayed the construction of systems upon a similar basis, would not seem to indicate the adaptability of the Stenophile to the representation of English with any degree of legibility.

(4). Machines for the Use of the Blind.

We have in several places in this volume pointed out how the earlier efforts of typewriter inventors were directed to the discovery of some means whereby the sightless were to be enabled to commit their thoughts and wishes to

paper, but nothing of any real value was discovered for many years.

About the time that the Sholes-Glidden typewriter was being introduced a decided effort was being made to popularise a wonderfully simple system of embossed writing invented by Louis Braille, in which six dots, arranged three high and two wide :: were so grouped as to compose a complete alphabet. Early in the eighteen-nineties, Prof. Hall, of the Illinois Institution for the Blind, invented the Hall Blind Typewriter, which embossed the Braille characters on a sheet of paper. The construction of the Hall machine was very simple indeed, since it provided only six keys and a spacer, the three left-hand keys embossing the first column of dots, and the right-hand key the second column. As in the case of the shorthand machines just mentioned, it made no difference how complex a particular group of signs might be, since one, or two, or all six of the keys could be depressed simultaneously.

The size of the machine is nine by ten inches and five inches high, and weighs nine and a-half pounds. It is simple and very strong and durable. There are but six keys to manipulate. Dots are embossed in the paper as in the Braille system, but with the machine the letters can be made very rapidly. Heretofore the blind have been able to carry mathematical calculations only as far as was possible by a mental process or by the use of the "octagon slate," which has not been found practicable in this country. Now they can solve all problems as other pupils do, and even music is within their reach. The rapidity with which the typewriter can be manipulated is surprising.

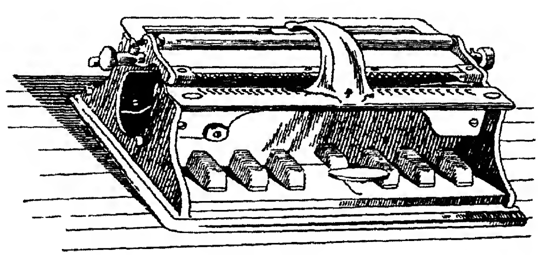


FIG 136.

A pupil, a pianist, after a few hours' practice, wrote a sentence of sixteen words in seventeen seconds, and a sentence written at random at a rate of thirty words a minute.

But the development did not stop there, for at last a

wonderful instrument, made in England and of purely English invention, was placed upon the market. This was called the Stainsby - Wayne Embossed Shorthand Typewriter for the Blind.

An illustration of this marvellous instrument will be found with this article. As will be seen, it consists of a framework holding seven keys. Now, since one dot or any any other number will take no longer in execution than is required to depress the keys, and as (as before mentioned)

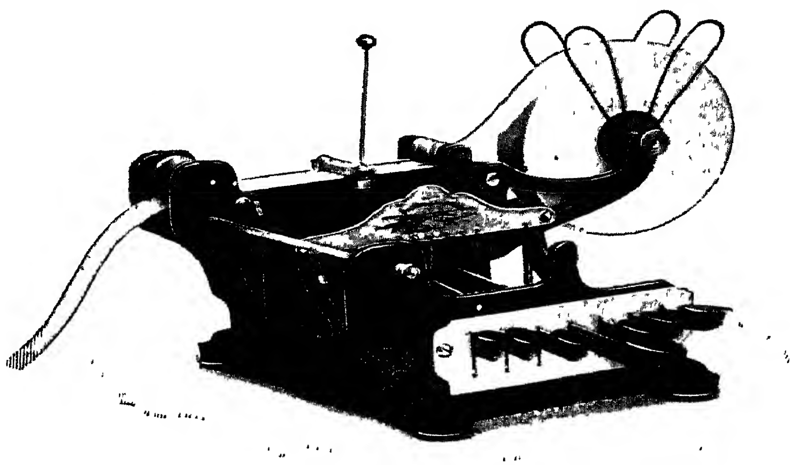


Fig 137.

upwards of sixty combinations can be made, it follows that by working upon a continuous tape a very high degree of facility can be easily acquired. This facility is increased by the free introduction of word signs, prefixes, affixes, phrase signs, etc., and so successful has the machine proved that there are to-day a large number of operators, totally devoid of sight, who earn a living by means of this machine in conjunction with the typewriter. They are shorthand clerks, and their duties consist of everything that this term implies. They take down, as we ourselves have witnessed, dictation at a speed of 140 to 150 words per minute No pencil shorthand can ever hope to vie with the mechanical method in its simplicity, nor one would think, in its speed That it is legible goes absolutely without saying. There can never be any question as to whether a sign is short or long, thin or thick, curved or straight. The most complex combination takes no longer to execute than the simple single dot.

A blind operator took down some test sentences in our

presence, we holding the watch and timing the operation. The work was transcribed on the machine, with an ease and elegance never yet surpassed by any sighted operator. The delicate touch of the operator gathered in every dot. Her nimble fingers outpaced the tongue of the dictator. The operator was a rival whom the most skilful typist might envy.

With reference to the use of the typewriter proper by the blind, it is known that in the early days of the Remington in this country, the machine was stated to be especially useful to blind persons to enable them to hold correspondence with sighted persons, and in the early days of the machine someone invented a framework to be laid over the keyboard for the purpose of affording a guide to the correct keys. In Bates Torrey's *Practical Typewriting* there is a special section devoted to this subject, and a mass of useful instruction in the method of fingering recommended by the author of the book is presented. Among many illustrations is an elaborate piece of tabular work executed by a pupil of the Perkins Institute at Boston (Mass.), a young man, totally blind, who had been using the machine for less than a year. Mr. J. W. Smith, the Superintendent of the Perkins Institution, thus expresses himself in connection with the relative abilities of the blind and sighted, "Take two persons of equal ability, one sighted and the other blind, and I will guarantee the latter will surpass the other in attaining facility in the use of the machine within any given time." No one will, we think, begrudge the opportunity for bread winning held out by the typewriter, when the world is wide for the seeing, but those who work in darkness have but a narrow field of labour.

CHAPTER VIII.

Front Strike Machines.

WE now reach a stage in our recital wherein we record the development of one of the most interesting theories of construction which has, so far, been submitted. At the moment of writing, inventors on all sides are working on machines of the kind herein described, not only in the United States, but also in Germany. Whether the Front Strike theory will ever become a universal favourite is hard to prophecy. But the whole idea is so simple, and appears to be meeting with such great success, that the various competing machines are worthy of the closest examination

Prouty. This machine was invented in 1886, by Messrs. E. Prouty & Company, of Chicago Lawn, Illinois, U.S.A. It forms the root of origin of the present series of writing machines, although the Daugherty machine was conceived at least two years earlier.

As may be seen on reference to the illustration, the keys to the number of forty-four are arranged in two groups, to the right and left respectively of a larger key used as a spacer. This, in itself, is a source of weakness, since it renders difficult the use of the thumb for spacing, and thus precluded the ready adoption of the machine by those who were already operators.

The ribbon was a very wide one, and traversed from the rear of the keyboard, right over the type-basket, into a guide, and then passed straight down, behind the type-basket, and under the machine, where it wound automatically on to a separate spool. The method of reversing the feed of the ribbon, as will be seen by the cut, was very simple. A dog or clutch played in the teeth of a ratchet wheel, and when one spool was full, the dog was lifted over on to the other wheel, and the ribbon reversed.

The carriage, it will be noticed, was elevated, and the type struck the front of the platen, through the ribbon.

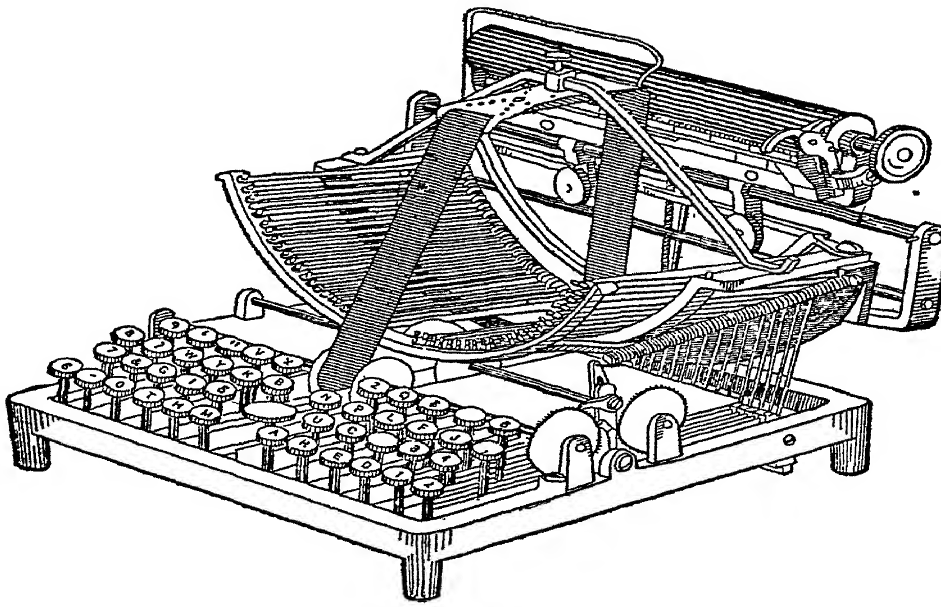


Fig 138

The latter being wide, always hid the last few letters, and thus vitiated the claim of the machine to visible writing.

The Prouty was not a commercial success, and its very name is now almost forgotten.

These points are, however, of little importance compared with the novel arrangement of the type-bars, which for the first time, are made to lie on their backs, with type upward, and herein lay the important feature which was, after many years, to be seized upon as the greatest advance in modern ideas.

The Daugherty. The general appearance of the Daugherty is shown by our illustration. The keyboard, it will be noticed, is of the single shift variety.

The end of the key lever—which is pivotted towards the centre—is shaped with a ⊃, or Jaw-shaped opening. The type-bar is shaped ⌐ and the hook of the bar engages in the jaw at the end of the lever. On the latter being depressed, the underneath portion of the jaw meets the bent portion of the bar (which is pivotted at the bend), and forcing it upward, throws the type end of the bar forward on to the platen. The type reaches the platen through a type guide and alignment is thus secured.

The Daugherty is seven inches high, thirteen long and

ten wide, with a carriage-guide-rail extending an inch and a half on either side, and it weighs about 16lbs.

The Daugherty keyboard is universal and the shifting arrangement does not depend on one small shift-key at one side, but there is a shifting arm with a large finger plate at either side of the board.

The type-bar action is thus described by the makers :—
"When the bar is at rest, the power is applied at the lowest leverage and moves towards the pivot as the bar rises to print. This gives the bar an accelerated motion. The farther it moves, the faster it travels, till the imprint is made. The slightest release of pressure on the key permits the bar to return with increasing speed to its normal position. The type-bars rest in a slightly inclined position, in the arc of a circle below and in front of the paper. They strike up into a central vibrating guide which brings the type to the point of writing in true alignment The bars rest between division plates, and and each travels in a separate path or groove. They are pivotted in such a way as to prevent end play, and yet permit of a little yielding or sideways movement. Then each bar has a safety shoulder on its back edge. Should a bar be at the point of writing and another struck against it, the flat space on the face of the second type block strikes the safety shoulder on the back of the first and thus prevents the type on the second bar being battered."

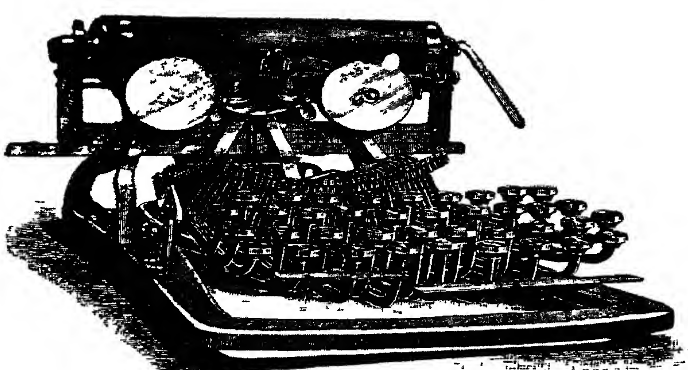


FIG 139.

Looking at the rear part of the machine will be noticed the ribbon carried on its guide. As the type-bar rises to print, the guide is thrown against the paper ; and immediately pressure on the key is removed and the type commences its return journey, the ribbon guide resumes

its former position, thus leaving the writing clearly in sight. The ribbon is carried on two instantly removable spools, and is half an inch wide. It may be turned, when exhausted, on one edge.

The carriage is also a specially devised one, and is said to be capable of hard wear, and to stand any amount of forcible blows. It is fitted with all modern improvements, and can be readily removed from the machine. The platen also, is easily detachable.

The Daugherty is the only type-bar machine having interchangeable type action. Loosen three screws, and the machine is in three parts *viz.*, frame, carriage, and type action. Loosen nine screws, and the machine falls in a heap. There are no slender pivots, no delicate threads, no connecting wires, no lifting of carriage, and in fact, "no nothing" likely to be a trouble, and the whole machine consists of but 105 parts.

After a few years had elapsed, the Daugherty was taken off the market, and an improved form called the Pittsburg substituted.

The Underwood Typewriter. The Underwood machine is manufactured by the Underwood Typewriter Company, of 241, Broadway, New York, at their factory in Hartford, Conn., U.S.A , and the President of the Company, as well as of the firm of John Underwood & Company, of New York, the world-renowned manufacturers of typewriter supplies, is Mr. John T Underwood.

This machine first made its appearance on the American market about twelve years ago, where it at once created the greatest interest, for it held the unique distinction of being a visible writer in which were embodied all the advantages of the blind machines as well as some peculiarly its own, and it is this distinction which has won for it the foremost place it occupies to-day.

It was introduced to this country in June, 1905, and has met with the same cordial reception.

So far as the general appearance of the Underwood goes, it will be noticed that there is very little to distinguish it, at first sight, from the ordinary single keyboard machine, and the universal order of the letters is followed. The shift-key acts in the usual way on the left of the keyboard as a shift-and-return key, and on the right can be converted into a shift-and-lock key, if required, which lock is instantly released by touching the left-hand shift-key. The carriage is on top, but does not lift up, as the types strike upward

FIG 140

in full view of the operator, thus bringing every character into sight, from date to signature.

The type-bar of the machine is interesting Its lower end, or, rather, the end furthest away from the operator, passes through the openings in a curved steel comb-like segment. The flat type-bar works freely and easily between these openings on its way to the printing point, where it meets a guide or alignment lock In this way, not only perfect but permanent alignment is secured. There is also a supplementary virtue in a type-guide or lock, namely, that should two keys be struck simultaneously neither of them can enter the guide, and false imprints are quite impossible. The segment referred to is fitted with a projection at the back and front of the machine to catch the dust caused by erasing and prevent it from going into the type-bar bearings ; also with a ring against which each type strikes as it reaches the cylinder, thereby causing uniformity of impression as well as saving the wear of the cylinder.

The touch of the Underwood is an agreeably light one, for which the reason is simple. In practically every machine the difficulty of touch is caused by the universal bar, which is held in close contact with the type-levers, so that when a key is depressed the force required is not only what

is necessary to bring the type to the printing point, but also enough to overcome the resistance of the universal bar. In the Underwood, this universal bar is fixed behind the type-bars, and is actuated by them in such a way that it does not commence its movements until the type is almost at the printing point; the resistance is then overcome by the momentum of the moving bar, and, as a matter of fact, the universal bar moves after the finger has left the key.

The Underwood was, we believe, the first machine which was fitted with a tabulator as part of the actual typewriter, and supplied without any additional charge. The occasions when tabular work is required are becoming more and more frequent, and invoicing, at all times a tedious occupation, becomes surprisingly easy when the tabulator is fixed to the machine. The Underwood tabulator is of a simplified form, and the carriage passes from one fixed point to another. Therefore, if irregular columns are required, as, say, units in a list of tens, it will be necessary to touch the space-bar once after depressing the tabular key; but it is rightly considered that this occasional use of the space-bar in such cases involves no mental hesitation or friction, and the simplified form, plus this spacing once in a long time, is certainly better than the more elaborate decimal tabulator which gives one ten or more keys to remember and find As fitted to the Underwood, the tabulator takes up no room, practically adds no weight to the machine and, moreover, it costs nothing extra.

The tabulator stops differ from those to which we have been accustomed. At the rear of the machine is a rack-bar, and below this is a circular rod on which the stops work freely, simply having to be placed in the desired niche on the rack. Not being detachable or loose, they can never be lost, and can never fall off when the machine is carried about from place to place. The tabulator key is at the top right hand corner of the keyboard, and can easily be operated by the little finger.

When using other forms of tabulating devices, the carriage flies along when the key is operated, stopping with a hard bang, and the result is a jarring and shaking which threaten in time to knock the life out of the machine; but when the Underwood tabulator key is depressed, the carriage moves easily and softly, the reason being that at the back of it is a little strip of leather—called an automatic buffer—which comes into contact with the rack on which the tabulator stops are placed as soon as the key is depressed.

Thus, the greater the pressure the greater is the resistance afforded, and *vice versa*. The device is so simple and so very effective as to command the admiration of all who see it.

The ribbon is carried on two spools, fixed to the main frame of the machine, on which it travels in the usual way; the ribbon movement mechanism, however, is unusually simple, and has so few parts that it is practically impossible for it to get out of order.

We now invite the attention of the reader to the front scale-bar of the machine, as shown in the illustration. The indicator, in the centre of the carriage frame, is used, not for the purpose of locating work, for this is all in sight, but for the dual purpose of setting the marginal stops in front and the tabular stops in the rear.

The marginal stops are placed on the rod immediately below the *front scale*, the left stop, regardless of its position on the rod, also ingeniously performing the function of ringing the bell and thus denoting the end of the writing line.

The marginal stop release key is conveniently placed above the left shift-key.

The paper fingers or guides slide easily on the rod just above the platen. For convenience, when handling heavy carbon work or stencils, these fingers can be folded over on a hinged joint, and the pressure they exert on the work in the platen is just enough to cause it to be held firmly and no more. There is no risk of scratching the stencil sheets or of smudging heavy carbon work.

The Underwood is a good stencil cutter. In this respect it pays a tribute to its rivals by admitting their powers, but justly claims to be equal to the best of them in every way.

As a manifolder its capabilities are unequalled. The average typewriter, when large numbers of sheets are inserted, produces indifferent alignment, owing to the fact that letters coming from all directions, as from circular type-baskets, do not find their proper printing point; but on the Underwood the common centre is not changed, because they arrive at the printing point from one direction.

Corrections are very easily made, for there is no need to consult scales or perform any mental calculations. Just erase the error, bring the gap left by the erasure opposite the type-guide or alignment lock, and then print in the desired letter. Like all the rest of the machine, this is simple and clear.

The types can be cleaned in a moment, another of its many conveniences

The Underwood is a silent machine, not entirely without noise, of course, but one of the very quietest.

The escapement mechanism is singularly rapid, requiring no speed dogs, and this, with the lightness of the carriage and the slight amount of force necessary to ensure its rapid movement, must make for the durability of the machine. There is an individual key tension, which permits of the finest adjustments at any time.

Apart from all the advantages afforded by the Underwood, and the host of good things it does possess, even a partial list of the things it does not possess is interesting, being, if possible, more eloquent. For the Underwood claims to be a complete typewriter, complete in itself, without the addition of any extra devices or attachments. It has, therefore, no special platen for manifolding and no special track to preserve alignment while so doing; no additional holders for envelopes or cards, no counting device, no tabular scales; nothing in fact, but what is supplied at the first cost with the machine.

The Monarch. This machine was placed upon the American market in the autumn of 1904, and found its way into England in the spring of 1905. As will be seen, the Monarch possesses the peculiarity of being perfectly open in front, so that no part whatever intervenes between the eye of the operator and the actual imprint.

The Monarch typewriter has a very interesting typebar, which is mounted in a broad hanger and securely pivotted to the machine. It does not depend for alignment upon passing through the teeth of a comb, and it has no aligning guide at the point of printing. As the machine is once aligned, it is claimed that the strength and breadth of the bearings will continue to keep it, but, of course, in the case of two keys being depressed at one time, there is nothing to prevent one of them reaching the paper out of real alignment.

The space-bar extends the whole width of the machine, and can be used by either hand, three shift-keys are provided, that is to say, one for each of the little fingers, to be used when only one or two capital letters are required, and the other, which is a shift-lock-key, is depressed when it is sought to lock the shift-key in order to use the capitals for a whole line or otherwise. The shift-key may be unlocked by tapping the lower left shift-key.

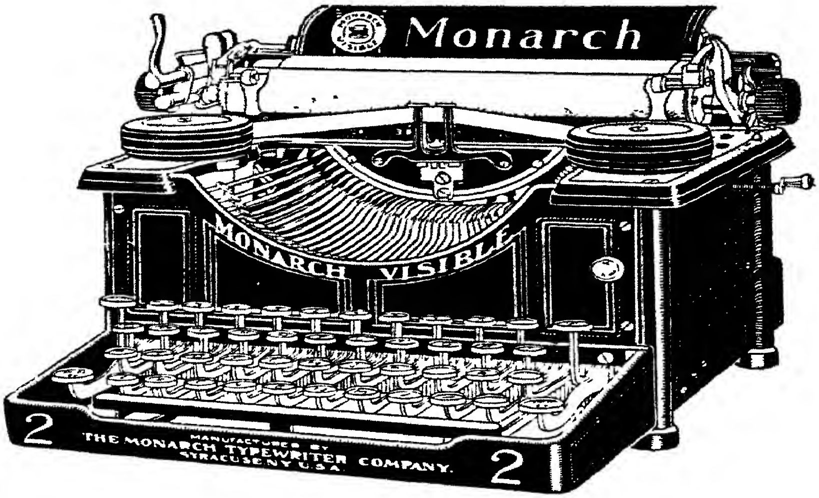


FIG 141

The depression of the shift-key does not affect the carriage, but raises the whole of the "type-basket," that is, the frame on which the type-bars rest, and so brings the upper case letters into position to strike the platen.

The ribbon is a narrow one, and has the lateral feed, so that its effective lifetime is very much increased. It is absolutely automatic in its action, and reverses itself without friction in any way. Practically, the reversing arrangement is the same as in the case of the Remington, as already explained.

The Monarch is provided with a tabulator, fitted with four stops. The tabulator key is fixed to the right hand post of the machine, and on being pressed, the carriage automatically flies to the point, at which the stop has been placed. The tabulator stops are fixed in a scaled rack-bar at the rear of the carriage and are protected by a hinged lid.

Behind the ribbon carrier is a small slide, which, when pushed upward, will grip close to the platen and in such a position as to secure a perfect printing thereon, either a card for card indexing or postal purposes, or a short, thick or awkward envelope.

The paper fingers slide along easily, and can be fixed so as to grip even the narrowest possible width of paper. There is no screwing or unscrewing, the pressure they exert is sufficient to hold the paper tightly, but not so

tight as to cause smears or markings on the underneath copies when carbon copies are being made.

Means are provided for separating the feed roll from the platen, in order to permit of the insertion of several thicknesses of paper. The paper grips at once, and feeds in very squarely There is no necessity for coaxing it in any way.

Three widths of line space are provided for, and the platen is free to revolve forward or backwards, to permit of writing on ruled lines. There is a platen knob at each end, and as far as is reasonably possible, every provision has been made for the duplication of parts, so that either hand may be employed to perform any work which may fall to be done. The margin blocks work on the usual plan of sliding on racked bar, and can be fitted at any point desired. The return of the carriage brings it to a dead stop, and there is no rebound in any way. The marginal release key will permit of the margin being passed over, in order to finish long words or write outside the left margin. It automatically recovers itself on the carriage passing over the part to which the stop is set. The right hand margin stop also acts as a bell trip. There is a pointer to indicate the exact printed point, and two scales, although such are hardly necessary.

The touch of the Monarch is exceedingly light, and the movement of the bar is very rapid, and the machine is also said to be a first-class manifolder.

The Sun Typewriter. The illustration of the Sun will at once reveal the fact that it is a visible writing machine, and that there is a keyboard of twenty-eight keys, which, working by means of a curious double-action shift-key, governs eighty-four characters The type-bars lie on their backs, and on depression of a key, fly upwards, and, entering a guide, strike the paper, after having taken the necessary supply of ink off a small ink roller, described further on.

Immediately on pressure being taken off the key, the bar flies back to its place of rest, the last character written being as clear and visible as the first, and the first no better off than the last.

If we examine the diagram of the type-bar, it will be seen that the whole movement is one of considerable novelty and ingenuity. The depression of the button causes the L-shaped lever to swing on its pivot, thus pulling the top of the arm towards the operator. This arm is connected to the type-bar by means of the connecting wire shown, and so pulls the lower spur of the type-bar also towards

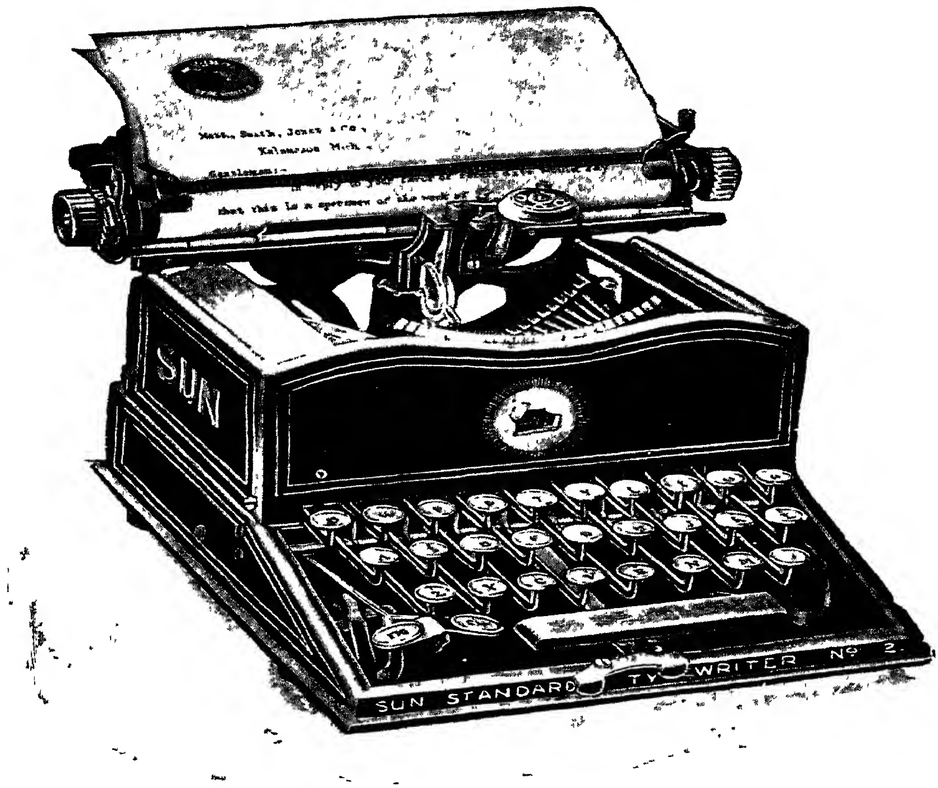


FIG 142

the operator. The bar is swung on the pivot by means of the strain through the wire on the spur (lug perhaps is the better term), and so forces the free end to assume a movement through a quarter circle towards the platen. It will also be noticed that there is a spiral spring, one end of which is attached to the framework of the machine, the other to the type-bar, so that, directly the type has struck the paper the spring takes up the natural tendency to rebound, and brings the bar down rapidly, but without force or shock, to its bed. The whole movement may be clearly gathered from the diagram.

The inking arrangements of the Sun are as novel as its type-bar. The illustration shows how it is effected. To the right is a circular pad, freely revolving on a pivot. This pad, which may be readily changed for another of different colour, is of felt, and supplies the smaller roller (shown in black) towards the left of the illustration. This

FIG. 143.

smaller roller is also pivotted, and when the machine is at rest, its natural position is in the spot indicated. On the type-bar moving to the printing point, it takes off from this small roller sufficient ink to make the impression, and then throws it against the ink supply, where it takes up just enough colour to supply the next character, and no more. It is thus almost impossible to get such an excess of ink as will smear the work, and the result is that the writing executed on the Sun typewriter is amongst the most beautiful which any typewriting machine ever has, or does, or ever can, turn out. The ink supply will hold an enormous quantity of ink, and can be replenished in a twinkling by pouring a few drops through the circular openings.

The illustration of this machine also shows, although not too clearly, the shift-key. This is a peculiar arrangement, a touch to the left raising the carriage two steps for figures, or a touch to the right putting it in the position for capitals.

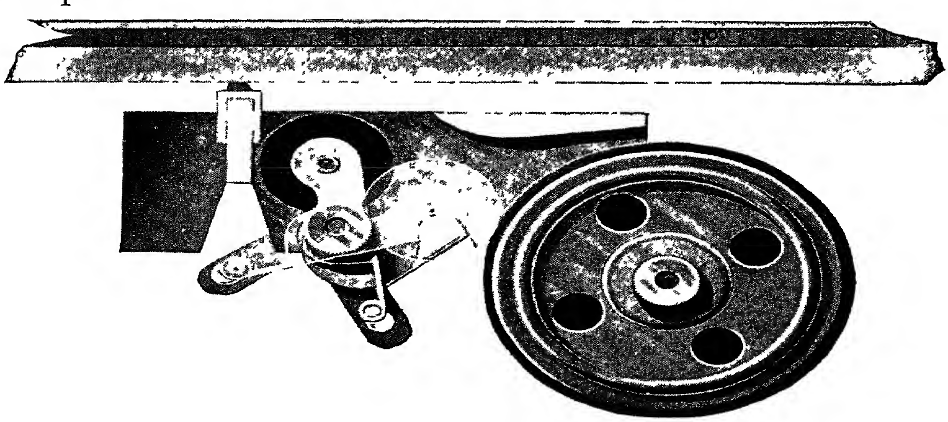


FIG 144

The paper feed is very good, and there is a release for disengaging the paper at any point, or for straightening it, should it be fed unevenly. Registering guides are provided to show the line of print, as well as the exact spot where the impression will be made. The line spacing gear can be thrown out in order to permit of writing on ruled lines, and there are usual stops for setting the margins and assisting in tabulating work. The paper guides are adjustable and will grip a full width sheet, or anything smaller. Bell trip, carriage release, and shift-lock devices exist, and are instantly applied or released.

Two models of the Sun are made. One, the No. 2, is a low priced machine suitable for private users or small offices, or would be useful as an auxiliary machine in large offices. This model has twenty-seven keys governing eighty-one characters.

The other, No. 3, is much more elaborate, and indeed quite a stately instrument. This has a greater range of characters, and presents a number of other convenient devices, all tending to assist in the rapid execution of work, and giving facilities for other special requirements The description above given applies, in its general outline, to both machines.

L. C. Smith and Bros.' Typewriter. Messrs. Lyman C. Smith and H. W. Smith, having brought the Smith-Premier into a condition which, in their opinion, could not be improved upon, began to look around to discover, if possible, in what other directions they could employ their talents. The result of their investigations led them to consider that the public was undoubtedly in favour of writing-in-sight machines, whereupon they sold out their interests in the Smith-Premier Co., and formed a new one, which in due course produced the machine now under notice.

If that hollow space underneath the top plate of the machine could be covered up, the uninitiated would be perplexed, at first glance, to discover wherein the advance was made. For it has been the aim of the makers of the new machine to disturb nothing that was worth retaining. The general details of the typewriter have long since been settled and practically all that was required was the power of seeing the writing as it proceeded. This power has been obtained by means of the upward stroke of the type-bar.

It will be seen that there are four rows of keys. These keys are arranged in the universal order, so that the operator

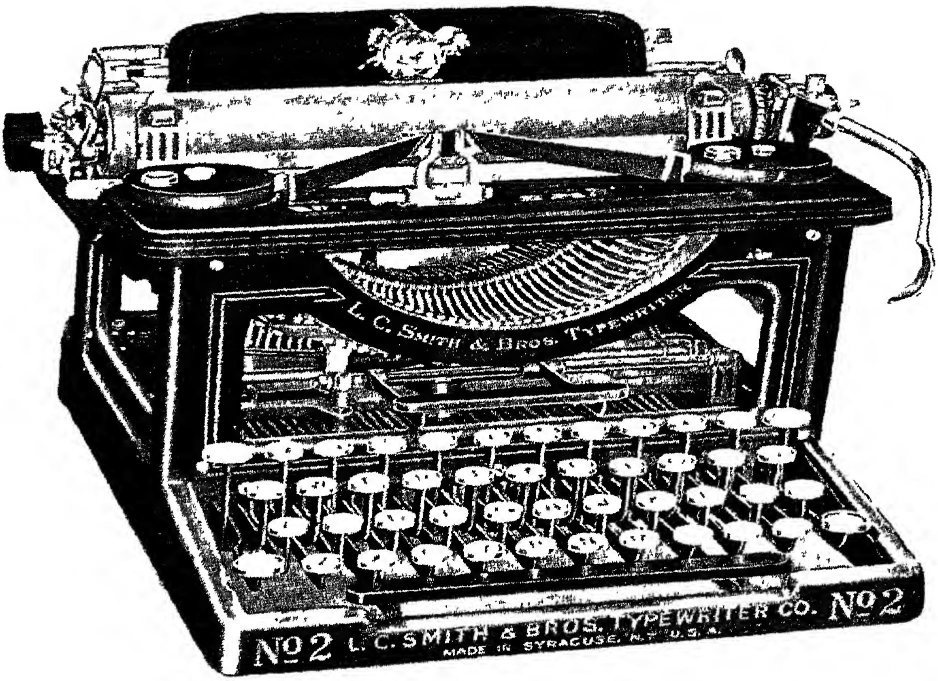


Fig 145

of the older machines may turn to the new ones without hesitation. Shift-keys are provided at each end of the keyboard, and keys at the upper corners of the manual are provided, that on the left side for the shift-lock, that on the right for marginal releasing. The space-bar is not so long and not so short, as in some machines, and an effort is thus made to meet the wishes of those who prefer either sort. At the top of the keyboard will be noticed what looks like another space-bar, but this is the tabulator key, and has been so arranged that it can be reached and readily operated by either hand, without lifting it from the position in which it may be when the previous key is struck.

The ribbon is carried on spools, and passes from one to the other, entering and leaving the ribbon carrier, or vibrator, on its way. It has not an automatic return, but must be reversed by means of the tiny level shown in the front portion of the machine just beyond the "R" in "typewriter." Means are, however, provided whereby

a two-colour ribbon may be used, the second colour being brought into use by pressing the small switch to be seen just below fifty on the scale.

Three degrees of line spacing are provided for, and variable spacing for permitting of writing on ruled lines can also be effected. The line spacing is made by the same movement as that which returns the carriage for a fresh line.

What is regarded as a valuable feature of the present machine is the ability to remove the platen in order to replace it with another, such as a hard platen for use in manifolding or mimeographic work.

As in the case of the Monarch, the depression of the shift-key affects not the carriage or the platen, but the type-basket, which is raised, and it is recommended to lock the shift-key in order to raise the type-heads whenever it becomes necessary to clean the type

The escapement of the Smith Visible is rapid in the extreme, the touch light and pleasant, and the machine has been devised in such a way as will permit of the hardest possible work being executed, with a minimum of wear and tear upon the parts.

The Fox. In addition to the machine mentioned in Chapter III., the Fox Typewriter Company have also introduced one falling within the present group of machines. As will be gathered from the illustration, the writing is visible and the writing line is in the direct line of vision of the operator. The importance of the type-bar is very strongly insisted upon by the makers, and we cannot do better than reproduce their whole argument in support of the methods which they have adopted in arranging the type-bar mechanism of the visible Fox.

"Any expert typewriter mechanic," says the Company, "will say, 'Show me the type-bar hanger and I will tell you how long the typewriter will retain its alignment and whether or not it will be durable.' The type-bar is that part of the typewriter that holds the type; when a key is depressed, it is the type-bar that swings upward and brings the type to the printing surface. Consequently, the bar must be strong and heavy, for it has many thousand such operations in every day's work.

"The type-bar hanger holds the type-bar in position The point where the bar 'swings' in the hanger is the 'bearing point' and it is the wearing quality at this point

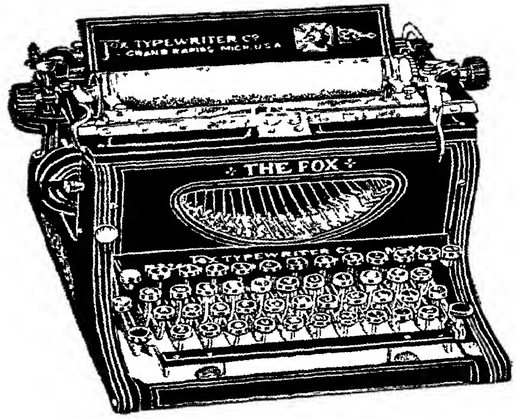


FIG 146

that determines the durability of any typewriter. In building the non-visible typewriters, it was possible on account of the greater room in the type-basket (where the type hangers are assembled) to use a bearing in some cases, as on the regular models of the Fox, nine-sixteenths of an inch wide, thus insuring an adjustable bearing and perfect alignment during the entire life of the machine.

"The bars in this case were assembled in a circle having a circumference of eighteen inches, but in building the visible typewriters (other than the Fox visible) the bars all had to be assembled in front and the 'circle' had to be reduced, so that instead of eighteen inches surface in which to assemble the type-bars, there were only four and a half inches, and room for a type-bar with a bearing point only the 35-1,000 part of an inch wide; consequently no wearing surface, no adjustability, and letters soon went out of alignment. In some visible machines, the manufacturers have endeavoured to overcome this defect at the bearing point by guiding the type to the printing point, employing a method known as forced alignment and acknowledging the defect in the methods employed to overcome it.

"On the Fox Visible, by means of the special way in which we assemble the type-bar hangers, we have made possible the use of a wide pivotal bearing in the hanger and built the first visible writer that is just as durable as the non-visible machines.

"Instead of assembling the bars all on one 'circle,' we have two segments, the lower segment having an assembling surface of eight and a half inches, the upper

segment having an assembling surface of four inches. In addition, the wide hanger, which is made possible, enables us to assemble them in such a way that every third hanger is placed on top, so that we gain four inches in this manner, giving us an entire assembling surface of sixteen and a half inches. This makes possible the use of a heavy type-bar with a pivotal bearing seven-sixteenths of an inch wide, and gives us an adjustable bar so that wear, as it occurs, can be 'taken up' simply by turning a screw, and the alignment retained during the entire life of the typewriter.

"We have in this construction united the durability of the type-basket machines with perfect visible writing."

The key tension is only two and a half ounces. That means it requires only two and a half ounces of expended force to print a letter

The ribbon movement permits either the single colour or the two-colour ribbon to be used. The action of the ribbon is entirely automatic, the reverse movements being absolutely positive and accurate, and requiring no attention from the operator.

When a single colour ribbon is used, the ribbon oscillates, which means that its entire surface is used; a feature which effects a wonderful saving in the cost of typewriter ribbons. One of the arguments against a typewriter equipped with a narrow ribbon in the past, has been that the ribbon wore out too easily on account of its limited surface The movement above described practically doubles the life of a ribbon.

When a two-colour ribbon is used, the colour is changed by touching either the red or the black button, which is situated at the left of the keyboard, when the desired colour is instantly thrown into position, a great advantage for all kinds of work where two-colour effects are desired.

The carriage is ball bearing, is operated with a tension of only one pound, which means that the force required to return the carriage to begin a new line is much less than is the case with many other writers.

The carriage is interchangeable, so that the regular models can be quickly changed into long carriage machines, doing away with the necessity of buying a special long carriage machine where the work requires the long carriage. This is a distinct advantage and a great saving.

The line spacing is automatic The carriage is returned to begin a new line by means of the line space lever. The one movement returns the carriage and spaces for the

new line, and either single, double or triple spacing can be secured.

The platen itself is instantly detachable from the carriage. This is a distinct advantage where a second and a harder platen is required, or where, in the case of extra work, two platens are desirable. Special hard platens for card work are furnished when ordered.

The escapement on the New Fox Visible is the same as that used on the regular models of the Fox It is a wheel escapement used in conjunction with the rocking-dog block, on which are mounted the escapement dogs By means of the lever on the dog block, the speed of the machine can be instantly changed at the will of the operator from "regular" to "reverse" This means that the typewriter will accommodate itself to the speed of the operator, no matter what that speed may be ; a feature which, it is considered, will be instantly appreciated by any fast operator

The Stearns Visible Typewriter. This machine, manufactured by the firm of E. C. Stearns & Co , of Syracuse, New York (who have attained considerable reputation as bicycle manufacturers), is advertised as being a writing and billing machine that embodies every known convenience and, as the illustration shows, has not only the virtue of visible writing, but is fitted with a decimal tabulator, and special provisions for the use of cards for card indexing, and so on. Particular attention is called to the attractiveness of the machine and the durability of its finish. The japanned parts are rubbed down to a fine piano polish, and nickeled parts are first heavily copper-plated, as a protection against rust, and are then nickled and buffed down to fine silver effect The other parts are first blued, or oxidised, and then lacquered.

As in the case of other members in this family group, there is a single keyboard, working with a shift-key, which is duplicated at each side of the keyboard. A shift-lock key (the last on the right in the second bank up) is also provided.

So far, of course, the Stearns Visible follows closely in the wake of other machines of the kind, but in addition to these features, it has a great number of others, which cause it to stand out in marked relief.

It was the first machine of its kind to possess a *decimal* tabulator, as opposed to jumpers This tabulator key is seen in the right hand side of the front framework. By

FIG 147.

its means, the carriage can not only be moved to any fixed point, but may be made to stop short at any desired place before the fixed point is reached. Thus all tabulated work can be executed with decision and regularity, and without ever having occasion to use the space-bar, in order to bring the various figures under their proper denominations.

The tabulator on the Sterns Visible does not require any special rack-bar, as in other forms. The mainspring which governs the movement of the carriage is contained in a large drum at the back. The periphery of the drum is fitted with series of notches or teeth, numbered from one to eighty, in order to correspond with the numbers on the front scale. Into any of these notches may be dropped the stops for the tabulator, and when the tabulator key is used, the carriage will then move to the spot at which the stop has been fixed.

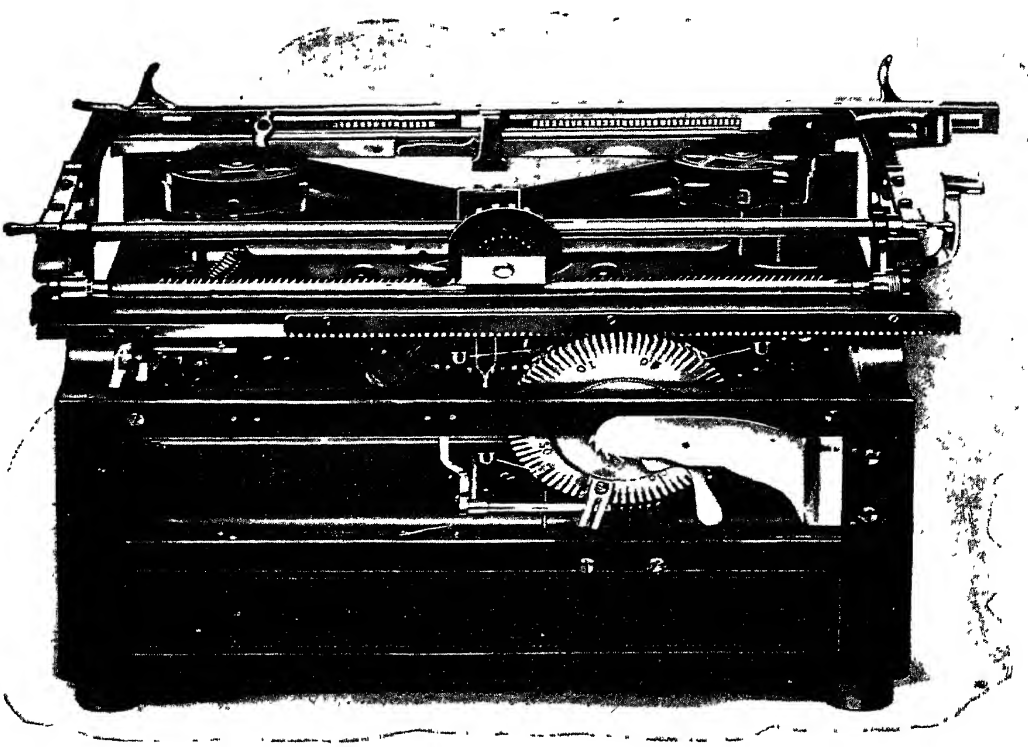


Fig 148

Just over the platen is a bar, carrying two small fingers, which grip cards or stiff envelopes when fed into the machine, and so secure even printing without smudging. This bar is operated by means of a lever, and can be brought into use or thrown out of gear in a moment The carriage can be readily removed from the machine, and the name plate in front can be lifted off for the purpose of cleansing the type when required The type-bar is a very quick acting one, and is fitted with a circular rib at each side, which rests in corresponding grooves in the type-hanger, so that it is almost impossible for the bar to gain side-play, or for dust to find its way into the bearing.

The machine has forty-two keys, governing eight-four characters, and will take paper up to ten and a quarter inches in width, writing a line of eighty-one characters

The Royal Typewriters. These machines—there are two of them, the Royal Grand and the Royal Standard—were placed upon the American market in the summer of 1906, and combine a number of very interesting features.

The Royal Grand sells at $100 and the Royal Monarch at $65.

The Royal Grand. This model, it will be noticed, has an open front, the type-bars striking at the printing point through an opening in a top cover or dust shed. The object of this dust shed is to prevent dust or erasings from falling among the type-bars, and as a further precaution in this respect, the pivot-ends of the bars are ensconsed in a hood. Any interference with the free movement of the type-bar is thus safeguarded against

The machine works with a single shift-key, which is in duplicate, and there is a shift-lock for use when all capitals are required. The touch is stated to be exceedingly light and pleasant, and an entirely new feature, which aids considerably in the attainment of this end, is the fact that at the ends of the dogs rollers are affixed, so that the natural tendency to revolve, which these attachments

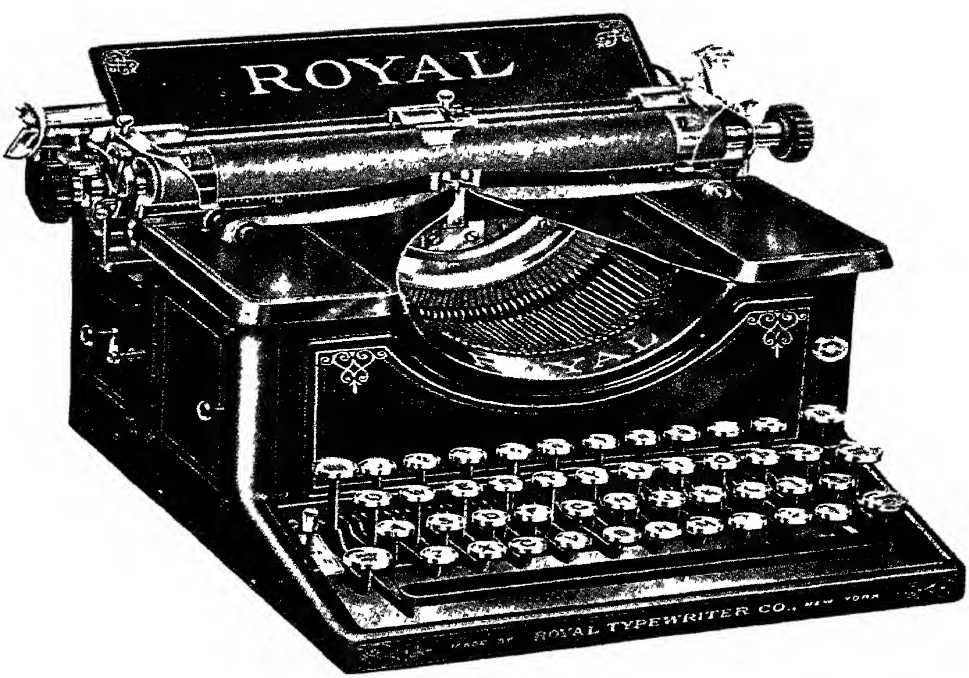


FIG 149

will manifest when pressure is placed on a key, entirely obviates the necessity for heavy pressure in order to overcome the resistance caused by the pull of the mainspring on the dogs and rack.

The Royal Grand is fitted with a tabulator, or jumper, enabling the carriage to pass rapidly to any predetermined fixed point, which may be called the decimal point. But to enable the operator to go back to the left of the decimal point, a back-spacer key is provided, so that after pressing the tabulator-key (which, by the way, is fitted with a brake which controls the velocity of its movement) the operator can at once go back again by means of the back spacer. Thus—

To write	.00	use the tabulator key		
,,	1.00	ditto, and back-spacer		once
,,	11.00	ditto,	,,	twice

and so on.

In order to write fractions, or other letters or signs out of the line, a device called the Exponent is provided. This attachment acts as a back spacer to the platen, and sends it back so as to permit of the execution of such compounds as e^5 2^5 HO^2 etc

Another clever and useful feature is the power to move the scale-bar up to the foot of the writing line in order to facilitate, with the aid of the revolving platen, the execution of writing on ruled lines, filling in printed forms, and so on.

The Royal Grand carries a two-coloured ribbon, either half of which can be brought into operation by means of a small pull lever on the keyboard, and the same lever will also serve to throw the ribbon entirely out of commission when the machine is required for stencilling work.

The type is guided to the printing point and locked during the act of printing. The usual feed roll release, carriage and platen releases, and sliding paper guides are provided, the latter being adjustable to the thickness of paper in the machine The margins are easily set, and the carriage stops dead on return without rebound, but the carriage may be driven over the margin blocks whenever required.

Another very valuable and interesting feature is the great length of line which can be written, no less than one hundred letters and spaces being provided for in the ordinary model.

The second machine built by the Royal Typewriter Co, is illustrated on the next page In its general construction, it follows closely upon the machine before mentioned, but it is, of course, not so fully equipped with accessories and refinements as the more expensive model. This lower-priced machine is already on the English market. It does very good work, and is rapid in operation.

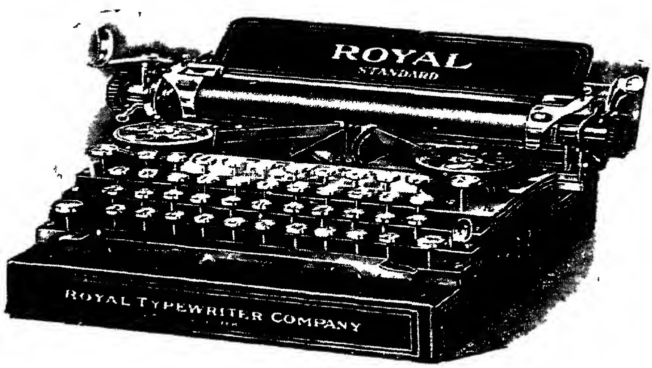


FIG 150.

The Secor Writing and Billing Machine. It will be noticed that this typewriter is not offered as a mere writing machine, but as combining special features that particularly adapts itself to invoicing, and therefore, it satisfies a more general field of demand.

The Secor is the first writing and billing machine possessing the important feature of an instantly removable escapement, namely, the carriage tension spring and its connection. This permits frequent and thorough cleaning of these vital parts, thus insuring better service and longer life. So ingeniously framed and protected are these parts, that it is impossible for them to be injured either in or out of the machine.

The escapement of a typewriter is as vital to the machine's long life and good health as is the heart of a human being. It is the heart beats of the machine that makes it work. They must be regular and positive. The heart of the Secor—its escapement—presents an entirely new idea, though based upon one of the oldest, time-tried and proved principles in mechanics—the famous anchor movement principle. Nothing like has before been applied to a writing and billing machine Its movement is wholly positive, though so slight as to be less than fifty thousandths of an inch.

The principle involved makes it impossible for the carriage to slip or skip, because the movement releasing the escapement wheel automatically catches the next tooth. Being made in a partial curve to fit the circumference of the wheel, when the releasing end is pulled down the catching end must rise exactly in proportion to the downward movement. This makes the quickest movement known to

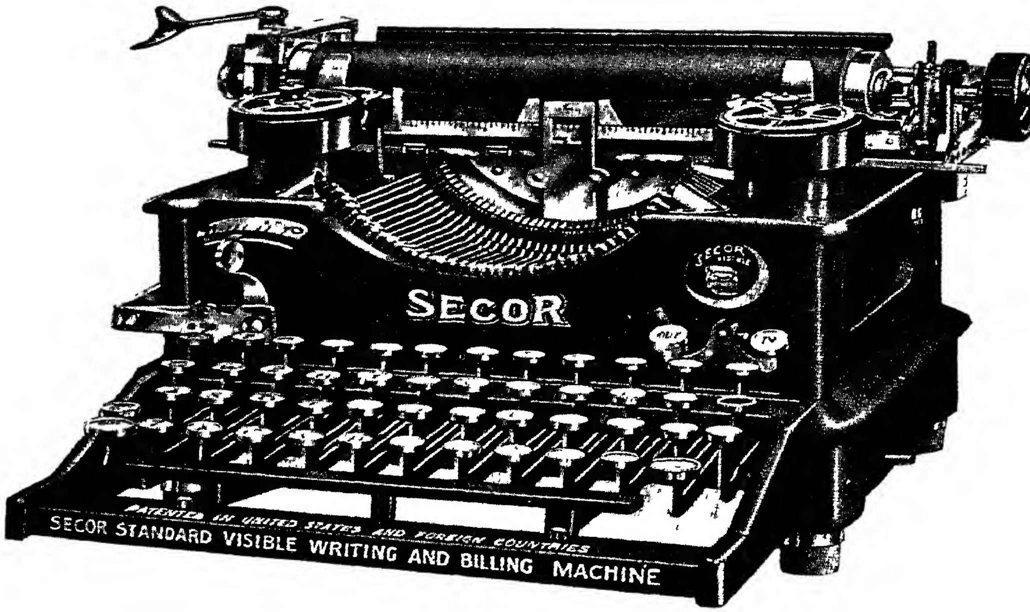


FIG 151

automatic mechanism, and insures, at the same time, positive automatic regularity.

However, with all the perfection possessed by the Secor escapement, unless the type-bar and type-bar action are equally responsive and perfect, the result would still be short of the highest efficiency. The Secor idea of the automatic action is no more pronounced in the escapement than in the type-bar and its action.

Another exclusive type-bar feature on the Secor is the control both of the impression and the alignment. It has a type-guide, which is a pivot-pointed ball, bringing every type-bar to absolute alignment without friction, completely controlling the type-bar, no matter how badly worn, against movement in every direction, both upward and downward and sidewise, except to and from the platen. A type-bar is out of alignment when the type strike too high or too low. The Secor has the only guide that controls and prevents this trouble. The guide on all other machines controls only on the side. This feature is patented, and therefore cannot be applied to any other machine.

The type-bar is made of tempered spring steel, wonder-

fully strong and substantial, although light in weight. All type are aligned before the type-bar is put into the machine, so that in replacing or changing the size or style of type, the entire bar is replaced, thus insuring uniform impression and alignment.

The type-bar bearing is likewise a new idea applied to an old and well-known principle. To say it is frictionless would be to state an absurdity, for the elimination of friction is unknown to mechanics, but it is so constructed as to reduce the friction to as low a point as is consistent with durability. The bearing measures three-quarters of an inch, and the type-bar hanger is ground and lapped.

The machine has a back-space-key, which will be highly appreciated by operators for making corrections in regular correspondence and in billing work. The mechanism is exceedingly simple, and is always out of touch with the working of the machine, except when actually in use. Therefore, there is no friction or complication, and absolutely nothing to get out of order.

The Secor ribbon movement presents another new idea. The ribbon never moves save when the key levers are depressed, since the space-bar operates independently of the ribbon universal bar. Running the carriage from one side to the other of the machine does not affect the ribbon, which remains perfectly stationary When the ribbon does move, it moves exactly the width of the type face, so that the type do not strike the ribbon twice in the same place It automatically reverses itself by a very simple patented device. By the raising of a lever the ribbon may be thrown below the printing point, and the type will strike the printing surface free, as in cutting stencils, etc. By touching a key on the keyboard, two-colour work may be had. Perhaps the most unique thing about the ribbon movement is the fact that the ribbon always moves exactly the same distance, whether one spool is practically empty or not.

Every Secor machine has, as a part of its make-up, a decimal tabulator with a capacity of fourteen figures, or eleven figures, two commas and a period. The tabulator is so simple, so accessible and withal so accurate that, were there no other superior features about the machine, every user of a typewriter would choose it in preference to all others. As many columns may be made as the sheet will hold. It is operated with one key, but the carriage stops exactly where the first figure is to be struck, whether it is 100,000,000 or .01. When the carriage stops

there is no rebound, as it is locked solidly in position—a patented exclusive Secor idea.

The keyboard is the universal single-shift, the No. 1 writing seventy-six characters and the No 2 writing eighty-four. The shift-key may be locked down for writing capital letters by simply touching the shift-lock, and may be instantly released by touching the regular shift-key.

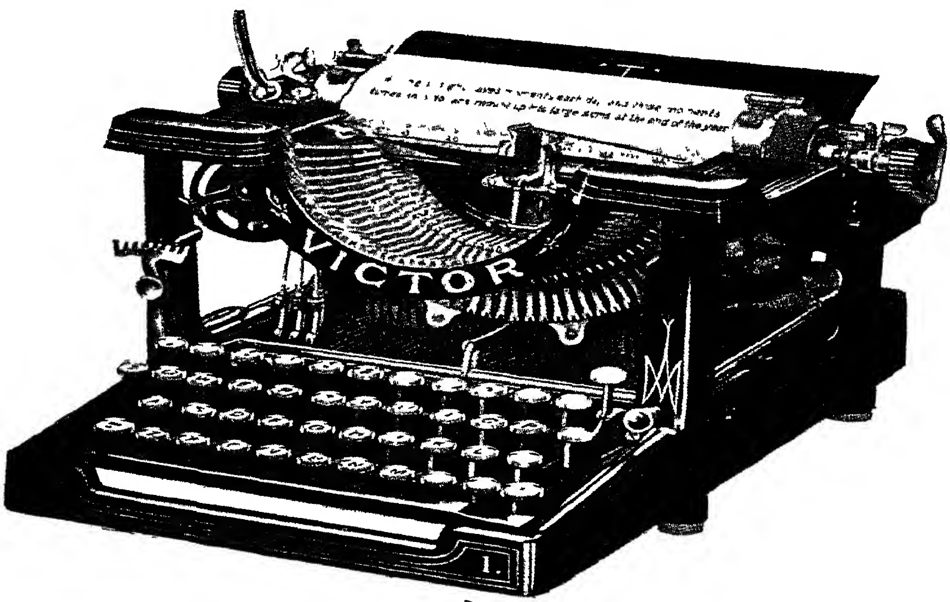


FIG 152

The Victor Typewriter.

This is a very elegantly made machine, in which, as will be observed, the bars strike upward. But the makers, considering that in certain positions writing effected on the front of the platen would not be so clearly seen as it might be, arranged that the imprint should be at a point of fifteen degrees above the horizontal. In other words, it is about a line higher on the platen than is the writing on the previous machines mentioned in this class. It is thus considered to be far more readable under all circumstances, as although the work of such machines as the Underwood or Monarch may be perfectly clear when the light is behind the operator, yet, when the machine is

placed on a table under the window, and the light comes from behind the machine, there are many occasions when the claim of the Victor would appear to be well founded. The type-bar is exceptionally strong, having a bearing an inch long, and it is fitted with an adjustable bearing for taking up any possible wear. The ribbon feed is claimed to be perfect, and is of the oscillating kind, so that every portion of the ink surface is used up. The carriage runs on ball bearings, and is so well adjusted that no lost motion or lateral movement can be detected. It is fitted with a release at both ends, so that it may be moved in either direction by either hand. The key action is stated to be snappy, resilient and responsive, and the machine is fitted with the usual scales, line indicator, etc. The feed rolls have received unusual attention, so that the feed is regular and independent of thickness of paper. The paper fingers are adjustable to any width paper, and owing to a light spring tension put upon them, they will carry paper in perfect spacing right to the lower edge. This is an improvement which several machines, now on the market, might very well incorporate. Nothing spoils the appearance of a well-typed sheet more than to find, as one so often does, the last line running down hill. The Victor is fitted with decimal tabulator, the key for operating which is shown on the left front post. This is not an "extra," but is part of the regular equipment of the machine. The margin stops are adjustable, and serve as a keylock, so preventing overpiling the letters at the end of a line. The line space is easily adjusted to the desired width, and can be thrown out of gear by a touch, thus permitting of the use of ruled paper, or returning to any previous line of writing. The keyboard, needless to say, is the universal one, and all that an operator can require a machine to do can be done with the Victor. We have seen it, and tested it, and heard many opinions expressed upon it by the dealers in New York, and believe the Victor to be an all-round good instrument.

The Remington Sholes Visible.

When we had the pleasure of examining this machine in New York, we were amazed at its extreme simplicity and effectiveness. It is a handsome machine, presenting an appearance of *richness* and quality which seemed peculiarly its own. From the illustration it will be observed that it follows the now current principle of upward strike,

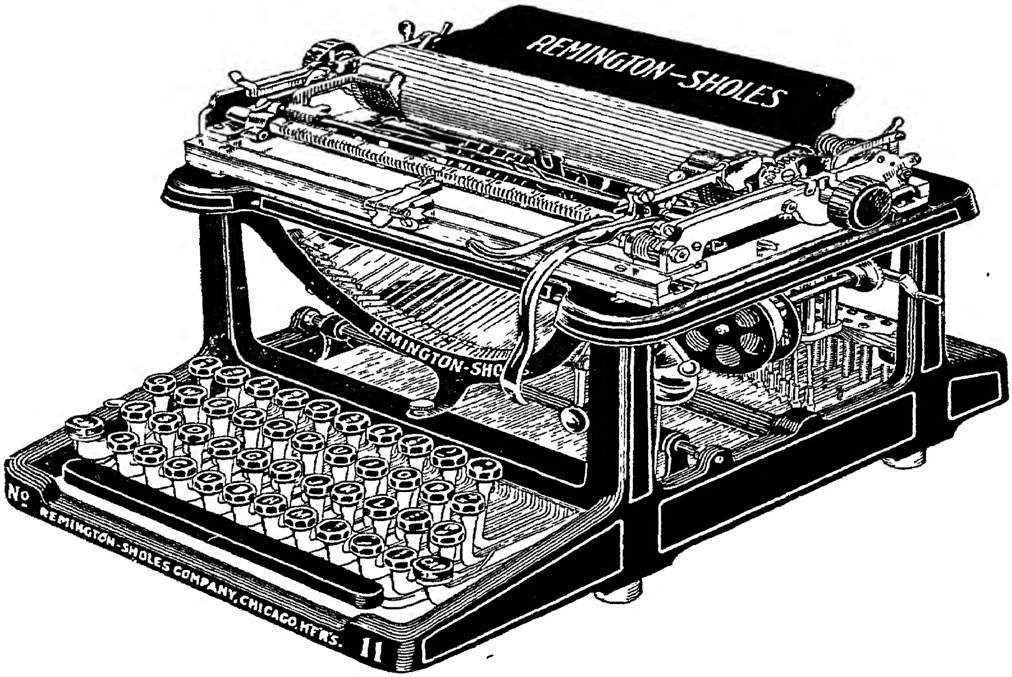


FIG 153

but the writing is just a little below the front of the platen, so that the typebar falls, by its own weight, directly the finger is removed from the key. It possesses this further feature, moreover, that by intercepting the bar in its flight before it assumes a perpendicular position, the force of the blow is considerably increased, and carbon work carried out to a very much greater extent than in many instruments. As the machine was very largely used for billing and other work in which a number of carbons were required, this point became one of considerable virtue.

The writing was, of course, in sight, and so were practically all the operative parts of the machine. The margin stops and tabulator stops were arranged on the front rod, and could be set without raising the hands higher than the front of the machine. The paper feed was beyond reproach. Separate levers were provided for releasing the pressure of the main feed rolls, the pressure plate, and the paper finger rolls, and when released the levers remained in that position until replaced, when the object for releasing them was attained. Both hands were thus left free to do whatever was necessary. There was

a line finder permitting of ruled lines being "hit" exactly, and of course the platen could be revolved in any desired direction.

In criticising previous machines on the upward strike principle, the makers remark: "Without exception all visible writers heretofore placed upon the market have been recognised as inferior to the old standard blind machines, in action, speed, and durability, and in their enforced use of a very narrow ribbon. . . . . . So far, in all the 'Visibles' yet brought out, whether top strike or front strike, the printing ribbon is shifted edgewise into the path of the typebar before each stroke in order to print, then shifted out of it again in order to disclose what has been printed to the eye. The ribbon therefore constantly shifts with each stroke of the keys, and this shift must be effected by the pressure of the fingers of the operator, which must overcome the sliding friction and inertia of the ribbon shifter and the resistance of its restoring springs. We have found that by lowering the printing line below the centre of the platen and *swinging* back the ribbon somewhat from the platen, it passes below the line of vision, and the operator can see all that has been printed without shifting it edgewise at all. This arrangement gives at once all the identical conditions of the ribbon movements which have worked so admirably for many years in *the old style blind* typewriter. The key action is entirely freed from the sluggishness of a sliding ribbon shift and the back swing of the ribbon itself acts as a light spring to start the type back from the ribbon point. At the same time, a ribbon broad enough for three tracks can be used, and it can be shifted entirely out of the way for cutting stencils."

It seems a little curious, however, that whilst objection should be raised, as we have seen in the case of the Victor, and shall see again in the description of the Triumph, to machines of this class because they do not print high enough, the present machine should remedy the defect by printing lower. The swinging ribbon carrier device was used on the Brooks typewriter, and other machines.

There are no crooked typebars on the machine, and the fact that the hangers were carried back under the platen prevented any dust or grit from erasures, etc., finding its way into the bearings. Very strong bearings were provided, both sides of the segment being utilised for assembling the bars, thus getting over the difficulty which so long stood in the way, owing to the limitation

of space which the use of the segment instead of a complete typecircle necessitated.

The carriage was fixed, the depression of the shift key to imprint capitals raising the basket, which fell of its own weight to lower case position again as soon as pressure was taken off the shift key.

The ribbon did not have an automatic return, but required reversing when it had fed across the machine, the makers thus pursuing the policy adopted by them in the earlier non-visible machines.

The various other features of the machine—margin stops, and locks, carriage release, feed roll release, etc.—all possessed the highest order of merit, and after a very careful inspection of this machine alongside a number of others of various makes, we could not help admiring its responsiveness, lightness of touch, and extreme simplicity.

The Triumph Visible.

In the machine now under review, which in some respects looks like a Bar-Lock, we find the visible writing principle carried out in a slightly different manner The makers draw particularly strong attention to the circumstance that writing, whether exactly on top of the platen, or whether exactly in front of the platen, can at times hardly be read, and they instance the difficulty of reading against the light a sheet of writing held at the same distance from the eyes as typewriting would be from the operator but perfectly flat, or the same sheet, lower than the eyes, but quite upright, in support of their contention. They have therefore so built their machine that the type strikes the paper at an angle of ninety degrees. They consider this a very simple principle, and although it was difficult to apply it to a typewriter, yet it was finally accomplished, and for this reason they regard the Triumph as the only *perfect* visible typewriter.

The Triumph, although selling at $60 only, is a very complete and likeable instrument. As will be seen, it is fitted with the universal keyboard, operating with a single shift key, the latter being in duplicate. It has not, however, the many elaborations and fancy devices incorporated in other machines selling at a higher figure.

In speed, the Triumph leaves little or nothing to be desired. The carriage runs on ball bearings, and the typebars strike and return quickly The writing being in sight, it is considered that no expensive tabulator is

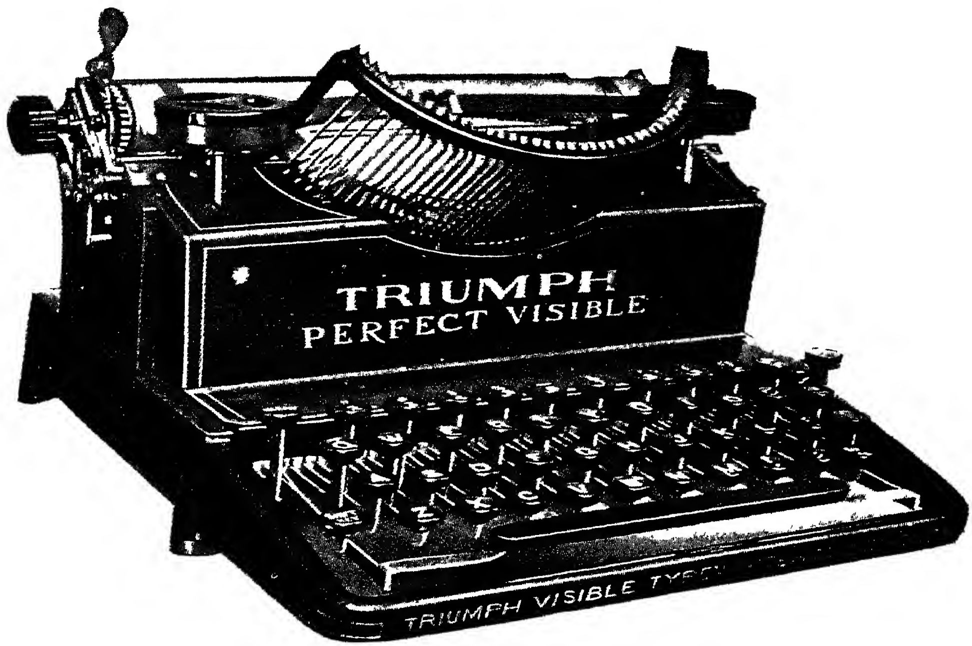


FIG 154

necessary. Marginal stops can be set to any desired spot, the carriage being released by means of a key for that purpose. The types pass through a guide, so that alignment is said to be perfect and permanent. The machine works with very little noise, and the touch is light and pleasant. The platen is a wide one, and the keyboard, extending to forty-two keys, and consequently capable of carrying eighty-four characters, will permit of the introduction of fractions or foreign characters, and means are provided for the action of dead keys, that is, keys which, when depressed, do not move the carriage, in order to permit of the introduction of accents, etc., in non-English words.

The Folding Typewriter.

Here we have a very portable and exceedingly light machine, capable of doing very fine work, fitted with the two-colour ribbon device, and made almost entirely of aluminium.

The machine takes its name from the fact that, when not in use, the platen folds over on a hinge so as to fill up the space over the keyboard, and thus enables the machine to go into the smallest space possible. The

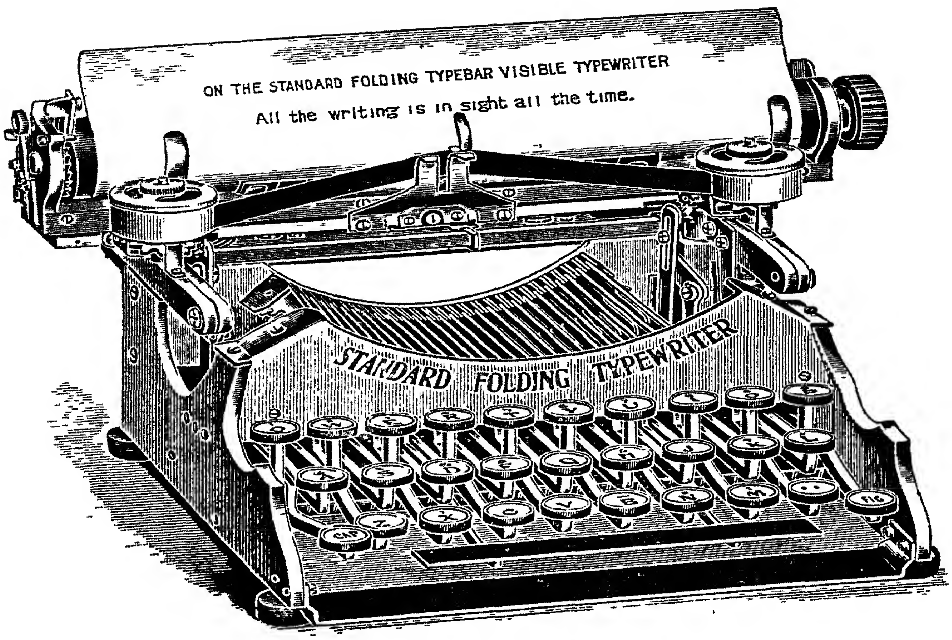


FIG 15

whole space occupied, when thus closed up, is only $7\frac{1}{2}$ by 10 by 5 inches, and the weight about five and a half pounds. The machine, when packed in a solid leather case can be carried easily on the little finger, and its compactness is such that it will go into a portmanteau or "grip" and hardly be noticed.

It will be observed that it has a double shift, and the types strike upward, alignment being secured by means of a typeguide. The ribbons are easily removable.

An inspection of the machine showed that it was well-made in every way. It could be worked at a very high speed. The typebar bearings are wide and have ample wearing surface to ensure long wear. The escapement, spring case, and other moving parts are all strong, well made, and well finished. The ribbon does not commence to move until the type starts to return, and so blurred impressions are not possible. The machine is fitted with a shift lock, but the paper fingers are fixed, which is more than a pity. Two degrees of line space are provided for, there is the usual bell trip, but no margin release. It will cut a good stencil, and we obtained five or six perfect carbon copies. It is a nice little machine, and is the traveller's typewriter *par excellence*.

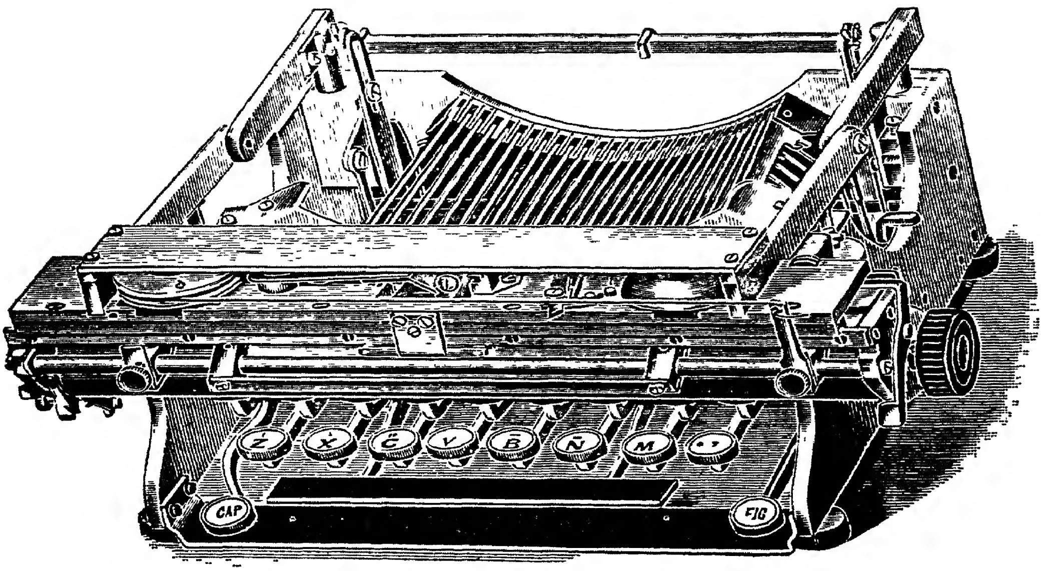


Fig. 156.

The illustrations show the machine in position for work, and also the machine closed up ready to go into its case. The price at which the machine sells, in America, is \$50. It is not, at the moment of writing, represented in England, but we believe that arrangements are on foot for this purpose.

The Emerson Typewriter.

This exceedingly handsome machine, although not strictly coming within the present group, embodies so many of the features of the section that, standing as it does *sui generis*, its place appears to be here rather than in any other chapter.

The typebars, it will be seen, are arranged in two rows, and on the depression of a key, the corresponding bar is swung forward to the platen, in very similar manner to the way a door is swung on its hinges. If one can imagine the two piles of type in the Oliver being laid on their sides, so as to strike the front of the platen rather than the top, the impression gained would represent the movement of the Emerson.

It will be seen that this machine is fitted with twenty-eight keys, and as each key carries three characters, the repertoire of the Emerson is eighty-four characters, worked

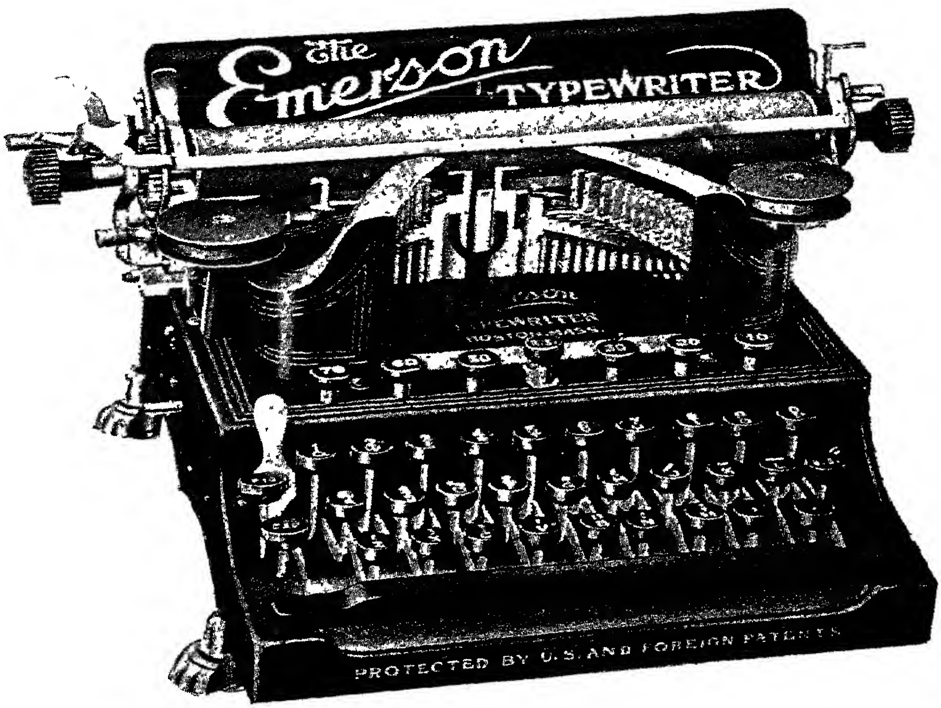


FIG 157

with two shift keys. The latter may be locked for all capitals or all figures.

The machine is fitted with a back spacer. and a tabulator which brings the carriage to any desired spot, passing over intervening points at which stops may be set, if it is desired to do so. There is a two-colour ribbon, and the change from one colour to the other can be instantly effected.

The Emerson is capable of turning out good mimeographic stencils, and does good carbon work, and is made to sell at $50 only.

The Visible Remington.

In view of the demand for visibility of writing, and the great headway made by machines having this feature, it was hardly possible that the non-visibles could continue the struggle against new ideas indefinitely. Many operators will be found who prefer the old-style hidden-writing machines, and such will continue until the old

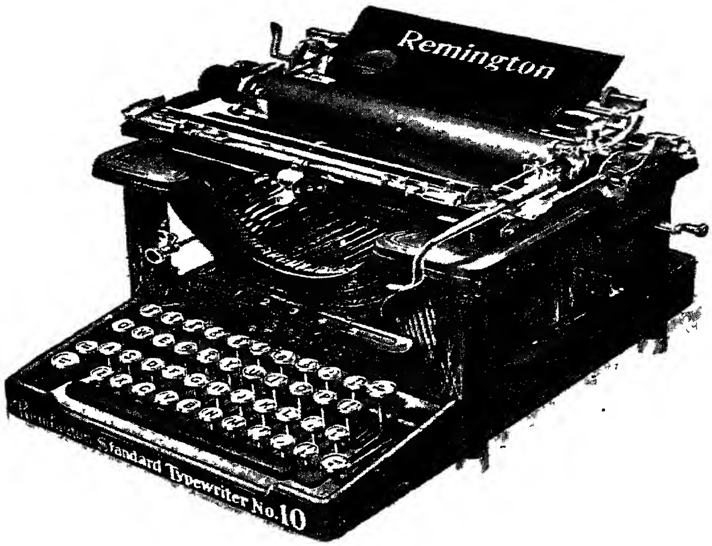


Fig 158.

machines have worn out and gone beyond repair. It could hardly be expected that the older operators who have grown to like—and in many cases almost to love—the instruments which have been their friends for so many years, could suddenly turn round on them in favour of the newer school of thought. But the ever increasing demand for visibility had, in due course, its effect, and the No. 10 Remington was the result.

It is claimed that the new machine is, before everything else, a Remington, and retains all the features which have given that name its prominent position. But the changes are so great as to justify us in regarding it as a new instrument, and upon this basis we proceed to describe it.

The keyboard is, of course, the universal one, and calls for no special remark. The typebars are strong, and strike upward to the front of the platen, and retain their old power of stencil cutting and manifolding. The machine is fitted with a tabulator, or rather a column selector. This is an improvement on the jumper used in many machines, and may well be regarded as an advance. Let us explain. In other machines, where the tabulator or jumper enables the operator to pass from fixed point to fixed point, there were no means of passing over intermediate points. Thus, if our tabulator stops were fixed

at 20, 40, 60, 70 (or any other numbers) and the carriage were at say 15, we should require to depress the key to bring the carriage to the first stop, 20, then again to bring it to 40, then again to bring it to 60, and finally to bring it to the last column, 75. But on the No. 10 Remington, by depressing the fourth tabulator key, the carriage is brought to the position in which that stop is placed. In the No. 11 Remington (an otherwise identical machine in every respect) a decimal tabulator is fixed, which not only permits passing to any place desired, but enables one to stop at any space not exceeding ten before that fixed place.

There is, however, a further merit about the Remington tabulator, since the rack on which the stops are fixed revolves, so that one may set no less than four sets of scales, and use one or the other without disturbing the rest.

There is a back-space key. The value of this device, which now finds its way on to almost all machines, is very great We think this one key alone is worth a considerable addition to the cost of any make of machine. We are not sure, but think it was first incorporated in the Hammond machine, then on the Densmore, from whence it spread.

The carriage runs on roller bearings, and moves lightly and swiftly, without jerk or sideplay. Carriage release levers are fitted to either side of the machine. The paper guides slide easily, and adjust themselves according to the margin stops. The pointer, always at the writing point, requires no setting. The paper feed is regular and true, and grips the paper firmly so that one may write at the extreme top or bottom edge of the paper, and in perfect alignment. The platen can be revolved backward or forward with ease.

Following the now common custom, a two-colour ribbon can be used, either colour being brought into action by turning a small knob in front of the machine. The ribbon reverse is quite automatic, and the ribbons can be attached to the machine on the spools on which they come wound, a great convenience when it is necessary quickly to change a ribbon. Moreover, the spools are placed under the top plate, away from dust and dirt.

The escapement of the machine is a new one. In place of two dogs working in and out of a rack, there is now a single dog mounted upon the upright arm of the rocker (as explained in an earlier chapter) which engages in the teeth of two escapement wheels and so prevents their revolving save as motion is communicated to them by

the operation of the machine. The dog is so adjusted, that when a key is struck, it is released from a tooth in the rear escapement wheel and brought into contact with the next tooth in the front escapement wheel. As soon as the key is released, the rocker goes back to its first position, and engages in a tooth in the rear escapement wheel. It is claimed that this arrangement of wheels and single dog gives a greater speed than any previous form of escapement.

The Smith-Premier, No. 10.

This machine must not be mistaken for the L. C. Smith Visible previously dealt with in this chapter. The appearance of the machines is very different, but the similarity of names may cause some confusion if not explained.

It is a visible writer, and retains many of the features of the non-visible machine. Thus, the keyboard is still arranged in straight lines, thus assisting in the acquirement of "touch" writing; there is a key for every character, and the platens can be removed and interchanged as before.

In the newer model, ball-bearing typebars are introduced and the back-spacer key is added to the keyboard. Like so many other machines, it has the "speediest escapement ever devised," and the change of colour of ribbon, when the bi-chrome ribbon is used, is effected from the keyboard. This is an advantage, as in the L. C. Smith machine, as one example only of many, it is necessary to reverse a small plunger right in the heart of the machine under the ribbon carrier.

Coming to details, the typebars in the machine under notice are hung on a single row of $\frac{1}{8}$ inch steel balls with facilities for adjustment. This is the size of ball usually employed in a bicycle pedal, and each ball is strong enough to bear a weight of several hundred pounds, with the result that these parts of the machine are practically indestructible. Some of the bearings have, it is said, been put to a mechanical test of 10,000,000 strokes under many times the pressure of ordinary writing, without showing looseness or wear. It is interesting to note that ten million letters, side by side, would write a line twelve miles long.

The typebars are covered whilst in the basket, and only come into sight when actually nearing the printing point. This is an advantage to the sight of many operators, who cannot stand the typebars continually "bobbing up

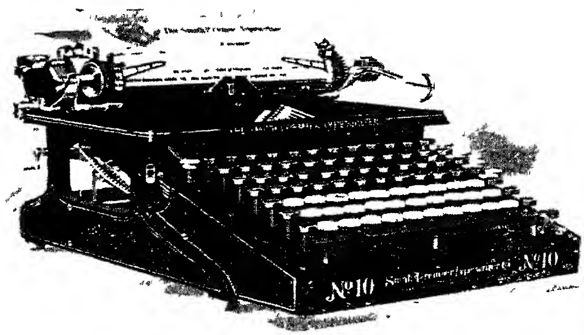


Fig 159.

and down" before their eyes. A consideration for the eyes of the operator has always been regarded by us as important, and we are glad to see it considered in the No. 10 Smith Premier. One of the first of the present class of machine which came to this country was purchased by us, but disposed of almost as soon as bought for the very reason that its open front caused the moving typebar to weary the eyes beyond endurance.

With regard to the escapement, so well is this adjusted that it is stated that the release is made by all the types when within only one-tenth of an inch from the printing surface on the platen, thereby reducing the time from the release to the type-contact to such an extent that the piling up of letters is a mechanical impossibility.

Another novelty, and great convenience, is the fact that the marginal, column finder, and tabulator stops are mounted on a swinging frame at the rear of the machine, but this frame can be brought into position above the carriage where the stops can be easily set without the necessity of the operator rising from his seat. This is a great advantage. On the machine on which we write these lines, it becomes necessary either to stand up, or turn the machine entirely round, in order to effect these operations. As in the case of the Remington, and also in the No. 15 Yost, as we shall see hereafter, the tabulator, or, as it is termed in the present machine, the "Column Finder," is so made that any desired column may be reached by the depression of the proper key, and the rack bar is reversible, so that more than one set of stops may be used.

The keys for carrying out various additional operations

on the present machine are arranged in rather novel places. Thus, the keys operating the change of colour of ribbon are placed outside the regular lines of keys at the top of the left hand side of the keyboard. The space bar of the machine is skirted by two other smaller bars, that on the left being the back-spacer, that on the right being the margin and line-lock release.

Taking it all round, the No 10 is a handsome instrument, capable of doing the highest class of work, possessing all the good features of the older models, and incorporating all the improvements which the advance of public opinion has, within the last few years, found to be necessary.

The No. 15 Yost.

Were it not for the name, and the fact that the present machine, like its forerunners, uses a pad instead of an ink ribbon, one would never identify this instrument with those previously bearing the same name The latest model has two especial features, viz.: visible writing, and it is a shift-key machine, the former of which the original inventor of the Yost did not apparently consider necessary, and the latter being a point which he specially sought to avoid, both in the Caligraph and in the machine to which he gave his name.

However, the No. 15 Yost appears at an opportune moment, and must be considered on its merits.

From the illustration, it will be seen that it presents an outline not differing very considerably from the others in the present class. The pad, by bringing the ink direct from the sharp face of the type on to the paper, must of necessity make for a much sharper and clearer cut impression than where the type strikes through a ribbon. The

FIG 160

claim of the Yost, therefore, to be "the typewriter of beautiful work" is well substantiated On the subject of the visibility of writing, the catalogue, no doubt with a thought of the arguments of former days, says "Possibly the experienced operator, possessing complete mastery over the keyboard, will not consider the question of visible writing to be of great importance. But it is obvious that the beginner will be assisted by this feature, while in respect to complicated figure work, the drafting of specifications, etc., even the expert will find it of value." The column finder is built in the machine, and is not an extra. As in the case of the Remington and Smith-Premier, the depression of a key causes the carriage to run direct to the desired column, without passing along in a succession of spasmodic jumps. Means are provided to prevent jar or undue strain on the carriage as it passes along to reach any desired column.

The centre guide, one of the original claims of the machine, is retained. This device not only aids in securing true alignment, but it effectually prevents misprints when two keys are accidentally struck together.

The pad containing the ink is held in its place by a couple of screws and can be readily removed It contains a vast supply of colour, and being covered by the types when at rest is protected from dust.

The shift key is in duplicate, the depression of one being sufficient to lock the shift for all capitals, and this can be released by touching the other shift key.

As at present sold, the 15 Yost (or Model "A" Yost) is not fitted with the back spacer This seems to us to be unfortunate, but possibly there may be good reasons in the minds of the makers for not adopting a device which, as all experience goes, is so useful.* This is, however, partially compensated for by the ease and comfort of writing on the machine. The peculiar movement of the typebar, which gradually rises from the pad, and straightens out, as it were, to the printing point, involves none of the eye-strain previously mentioned.

The escapement is swift, the carriage is rigid and travels very lightly, and all the minor points, *i.e.*, paper guides, carriage release, feed roll release, margin stops, etc., are all up to date in every respect.

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* We understand that in later machines this key is being fitted, and the Fox Typewriter has now followed suit.

CHAPTER IX.

European-made Typewriters.

(1). French Writing Machines.

THE efforts made by some of the more prominent workers in France have already been referred to. From a most interesting pamphlet entitled, *Les Machines à Ecrire Françaises*, written by a most painstaking historian, M. Georges Senechal, of the *Institut Stenographique de France*, we have derived many additional details, the substance of which we append, referring the reader to the pamphlet itself for those more precise particulars which it would be hardly fair to reproduce more fully. The impression left on the mind is, that the workers of those days did not possess a clear appreciation of the possible ultimate end of their labours, or the world might have possessed a practicable typewriter long before it did. For convenience, we present the matter in chronological order.

Pingeron, in 1780, attempted to assist the blind by enabling them to write by mechanical means. A long description of his machine will be found in the *Bulletin de la Societe d'Encouragement pour l'Industrie nationale* for 1805. To show the disinterestedness of the workers in those days, it is admitted that this effort inspired the producer of the second machine to labour on the same lines, and that the appreciative account of the second machine is written or edited by the inventor of the first.

M. L'Hermina, in 1784, developed a machine also for the purpose of assisting the blind to write. It was practically a table or desk, having a frame-work thereon, such frame-work being so shaped and slotted as to assist the

writer to find equal distances between the lines, and then write straight. A fountain pen is recommended for the purpose.

Progin (1833), to whom we have already made reference, was next to move, and, as we have seen, his labours were in a totally different direction. He sought three objects in his instrument, namely: (1) To print as rapidly as one could write with an ordinary pen, (2) To make stereotype plates for use with ordinary printing presses, and, (3) to copy music or make stereotype plates for the printing of same.

Bidet, in 1837, produced a peculiar machine which he termed a Mechanical Typographic Compositor. This instrument, although not a typewriter, possessed at least four of the essentials of a good writing machine, and may therefore be described at length. It consisted of two posts, carrying at the upper portion a wheel, on the periphery of which were the types. These types, as they revolved on the wheel, took a supply of ink from two small rollers, one on either side. Below this wheel was a cylinder, for carrying the paper. Evidently the cylinder revolved between each letter, and made a side movement between the lines The wheel had to be revolved by hand, until the required letter was over the printing point, when pressure upon a lever which bore on the axle of the type-wheel brought the latter into contact with the paper, and thus secured the impression. A writing machine, certainly, but a very slow one.

Dujardin, in 1838, elaborated an instrument which he termed a "Tachygraphe." He made two intruments, one a small one for recording speeches, and a larger one for music. Practically, the instrument resembled, in some respects, a piano, at the end of the keys of which were the various letters, which all struck to the common printing point.

The next year, in 1839, M. Perrot produced a "Machine Tachygraphique" having a vertical cylinder and two type-wheels The imprint was obtained by means of a wheel having an escapement hammer or bar striking on a socket. The keyboard was divided into two parts, one for each hand and each hand also had its own type-wheel. As soon as the bar was released, it struck the socket of the wheel, and printed the letter on the paper. Here, apparently, we have the origin of the "automatic impression" one reads about occasionally!

Four years then elapsed when Messrs. Baillet de Sondalo

et Coré took out (in 1841) a patent for a Universal Compositor which would replace all typographical material, and even the pen, and would also render unnecessary the study of shorthand.

Foucauld came next in 1843-50, and we have already referred to and illustrated one of his instruments. The second machine was termed a Printing Keyboard, in which there were sixty type-bars arranged in four rows. The bars had a downward motion to the paper, and the impression was effected through a sheet or slip of carbon paper. A special key was reserved for spacing purposes.

M. Pape produced his machine in 1844. using only twenty-four keys for the letters of the alphabet. The paper was carried on two rollers, and in order to see the writing, the keyboard was lifted, and not, as in machines of to-day, the carriage.

Labrunie de Nerval, in 1844, also produced a "Stéréographe" which consisted of two principal parts, the one being for setting the type into position, and the other being the portion required to receive the impression. The inventor provided a series of type-wheels, which were mounted side by side on a shaft, supported on slotted posts. These wheels were revolved by means of handles until the required letter was at the lowest point directly over the paper on the platen. A whole line would thus be set up, when pressure upon long side handles would bring the type (already inked by means of a handroller) into contact with the paper, and a turn of another handle would then move the paper up in readiness for a fresh line.

Rohlfs and Schmidt, in 1847, produced a machine employing a rotating prism, having the letters embossed thereon, and in this case the paper was forced to the type, as in the Hammond.

The next French patent was issued to Mr. Francis, of New York, in 1857. Particulars of this machine have already been given, and need not be repeated here.

Guillemot, a maker of "instruments of precision" (*i.e.*, mathematical instruments) took out a patent in 1859 for a machine which he described as a typewriter. In describing this patent, the inventor states that it is for "a machine for corresponding or quoting, etc." and it is made so that a person not able to write or suffering from infirmity, can use it by simple contact with the notes which print a certain number of letters, and thus record his thoughts." He considered that his machine might be used to advantage

by the blind. The machine was based upon the type-wheel principle, and inking was effected by means of a pad.

Codville, in 1861, produced a machine which he called L'Ecriveur or "The Writer." There was a frame-casting to receive the principal parts of the machine, and a series of forty-eight keys each bearing the necessary letter or sign. In order to denote capitals, a special key was provided, the depression of which ornamented the lower case letter, which was thereby denoted a capital. But these two keys (*i.e.*, the letter to be printed and the ornamenting mark) had to be depressed at the same time, in order to avoid double spacing. Here, possibly, we have the germ of a "Duplex" typewriter.

Flamm, in 1863, took out a patent for a mechanical compositor; and two years after the machine of George House, to which we have already made reference, was patented in France, and in 1867-9, Fontaine, a Barrister-at-Law, took out some patents, one of which was for a typewriter, in which the types were mounted on a rotary disc. The machine was operated by means of electricity.

(2). German Typewriters.

It will be seen that the makers of German Writing machines started away with a much clearer idea of the object of their labours than did their French neighbours; but this possibly arose from the fact that the early German machines were much later in making an appearance, so that by the time the Teutonic people got to work, the object of the writing machine had been well thought out, and a definite aim agreed upon. Like the French, however, many of their earlier efforts were of little practical value, but it must be urged most strongly that even the smallest effort deserves consideration; for each machine, however insignificant as a whole, might possibly have developed or improved some part, even if but a small one, and so aided in arriving at the present highly developed instruments. To-day, there are a number of German machines, of indigenous growth, which occupy very prominent niches in the field of fame. In Germany, as elsewhere, machines fall into three particular groups, namely, those which are good, those of which the goodness is questionable, and those which never had a chance to be good or otherwise, but died at their conception.

The student will undoubtedly observe that several machines are being made according to American ideas,

under licence or otherwise from the parent Companies. Such include the Caligraph, Ford, Empire, Jewett, etc., each of which is mentioned in the following particulars.

Adler. The German edition of the Empire, and so named in honour of the German makers, the Adler Fahrradwerke, of Frankfurt, A. M.

Burg. An unmarketed type-cylinder machine.

Buttner. A simple form of wheel machine.

Bracklesburg. In this machine, types were arranged on several segments, capable of moving in a vertical plane, and with their axes set side by side, so that two or more letters can be printed simultaneously, simply by the act

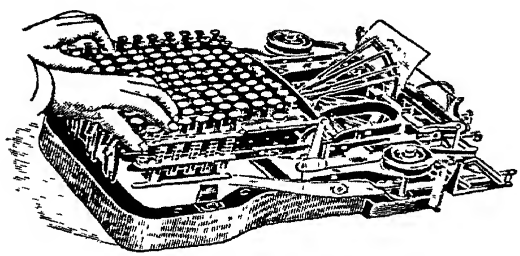


FIG 161

of pressing the respective keys. In the machine under notice, there are 132 keys, arranged in nine tiers, and comprising three complete lower case alphabets, one set of upper case characters, numerals, punctuation marks, etc.; and the number can be almost indefinitely extended by adding more type-segments, together of course with the corresponding keys.

Cito. This is a new machine on the front strike principle. The construction is very simple, and the thirty keys govern ninety characters by means of two shifts. It has only been (at the time of writing) a very short time on the market, and its success or otherwise cannot, so far, be judged.

Continental Typewriter. This machine is made by the Wanderer-Fahrradwerke, of Schonau, by Chemnitz. It is a front strike machine, working with a single shift-key, and adopting the universal keyboard, saving only that the keys for z and y change places, the former letter being placed after t in the third bank, and the latter being brought down to the lower bank, before x. The inking is effected

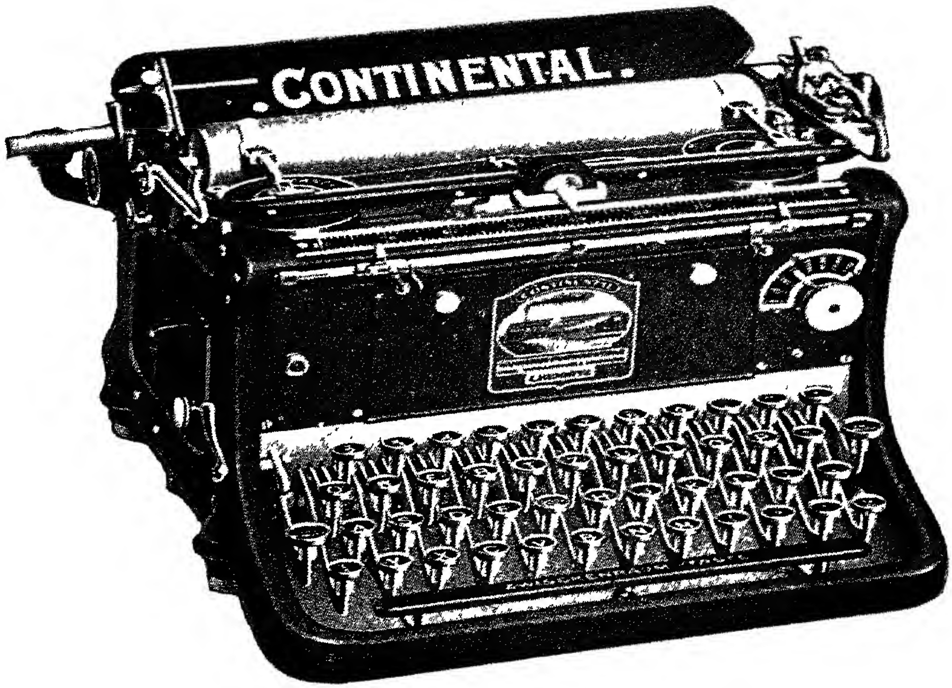


FIG. 162

by means of narrow ribbon, wound on two spools and passing through a vibrating ribbon guide, which also serves as a type-bar guide, so securing due alignment. The paper fingers are adjustable to any width paper, and are so constructed as to yield to the pressure of several thicknesses when carbon work is required. The scale is in front of the framework, and it will be seen from the illustration that the margin stops—one on each side—can be set from the front of the machine. On the paper shelf is an adjustable guide, securing an even margin as well as perfectly straight feeding of the paper. The working parts of the machine are enclosed and protected from all dust, but this front cover is opened by the movement of the lever at the left front post. When this is down, the interior of the machine is at once accessible for cleaning purposes.

At the left of the machine will be seen the tabulator, which affords means of writing in true columns according to an octagonal arrangement.

The Continental possesses all the usual features of modern machines. The platen is free to reverse, carriage release and platen throw-outs being provided. The ribbon can be easily changed, and the general appearance of the instrument is altogether pleasing and attractive. It is a good manifolder, and cuts a very clear stencil.

Discreet. This machine was a simple affair, having a wooden base, with supporting rails to grip the paper and support the printing mechanism, which travelled from side to side of the rail. The general appearance was not unlike the Dart Marking machine (which see), and there was an additional index plate swinging loosely over the principal plate. By arranging beforehand with a correspondent upon a code, this secondary index plate could be set to enable writing to be performed in cypher, but of course, the question of frequency, and combination, would readily permit an experienced cryptographer to solve any such writing.

Edelmann. A German made type-wheel index machine. A movable carriage was mounted on a base-board, and a hinged post carried a type-wheel which revolved by the movement of a handle. It possessed no point of especial interest, although good writing could have been executed.

Frister and Rossmann. A German edition of the old Caligraph, made under license from the parent company, but now discontinued.

Graphic. This machine was on the plan of the Hall. There was a metal base, having at the rear two short posts carrying a backway rod. Supported on this rod is a top plate carrying the types and manipulated very similarly to the Hall. Examples are not uncommon in this country,

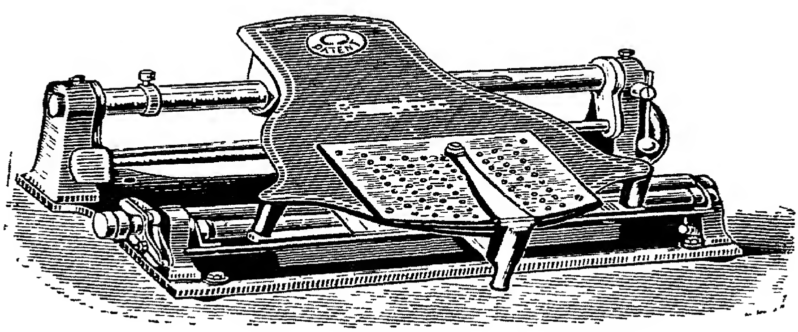


FIG 163.

but the machine possesses no great excellencies to render a more detailed description necessary.

Germania. Two or three distinct machines appear to have been made to which this name is given.

One was apparently a close copy of the Underwood typewriter, since it possessed the features of the front stroke, with ribbon movement, etc.

Another is a copy of the Jewett Typewriter, already described, and was made under license from the Jewett Company. This bore the distinctive title of Germania No. 3. In 1906, it was stated that the machine would be no longer made in Germany, and any further orders would be fulfilled by American made machines.

According to Dupont et Canet's work on Typewriters, another model is stated to have resembled the Jewett, save that it was operated by means of electricity. We are inclined, however, to think that this last statement is an error, since no one, to whom we have referred this point, seems able to throw any light upon it.

The Hammonia. This machine consisted of a metal table, on claw-feet. At the rear of the table was a back-way rod, and in front a raised slip of metal where the impression was made. Travelling along the back rod, was a kind of platform, having down one side of it an index. Attached to the rear of the platform, and working loosely in a slot, was a bar of metal, 9 inches long, having on its knife-edge a series of letters engraved. To use the machine, the paper was laid on what may be called the printing table, being held in position by a roller. The type-rod or knife was then moved backwards or forwards until a projection thereon arrived at the letter desired on the index. The end of the "knife" was then pressed down, and the impression made through a slip of carbon paper which was fed from a coil, housed in a drum at the side of the platform, which travelled between each letter.

Hassia. A front stroke visible, having forty-five keys, governing ninety characters by means of a single shift-key. There is no Tabulator. The platen can be easily removed, and the price of the machine is £17 10s.

Hazen's Type-wheel machine seems to be so nearly identical with the People's and the Champion, that the accounts of those instruments may be perused in order to understand it.

The Hansen Writing Ball. In this machine, which is still to be found in many offices on the Continent, the

base was of wood, about a foot square. On this was a metal frame or casting, supported on feet. In this frame were holes, corresponding in number with the letters, signs, etc., employed, radiating upwards in every direction from a printing point in the centre of the case. The type-bars were simply straight rods, made to slide in the holes, and working like pistons, pressed upwards by springs. The types were cut on the bottom ends of the bars, at angles to suit their varied inclinations, and on their top ends

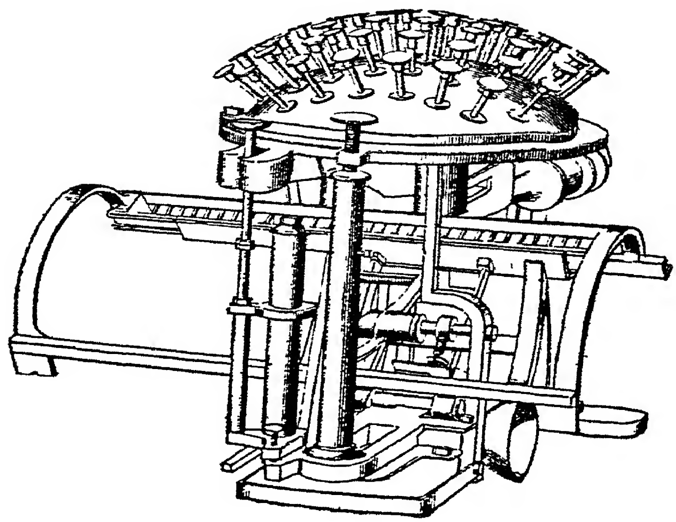


FIG. 164

were buttons, lettered like those now generally used. The lengths of the type-bars were such, that they gave the general outline of a hemisphere. Hence, the name given to the machine. The paper passed over the base, and under the frame containing the type-bars. There were either rollers or their equivalent, which gave the proper intermittent motion to the paper, and a line-spacing arrangement.

The inventor was a clergyman residing at Copenhagen, in Denmark.

Hurtu. The local name of the machine known in England and America, as the Ford, and so called from the name of the *concessionaire* in Germany.

The Ideal. The Ideal Typewriter is, although of American invention, yet manufactured in Germany, and was, for some time, the only German made machine represented

in this country. It is a type-bar machine, each bar being made of steel formed in a U shape, like the ribs of a paragon frame umbrella, giving lightness and rigidity, and all bearings are dust-proof. The alignment of the Ideal is secured by a directly guiding lever ; an individual type-bar guide ; and type lock at the printing point, ensuring perfect and permanent alignment. Since all bars strike from one direction only, alignment is not affected by the increased thickness of paper used when manifolding. The important feature in the Ideal is its tabulator, by means of which it is possible to write columns of numbers by the manipulation of one lever only, but this involves

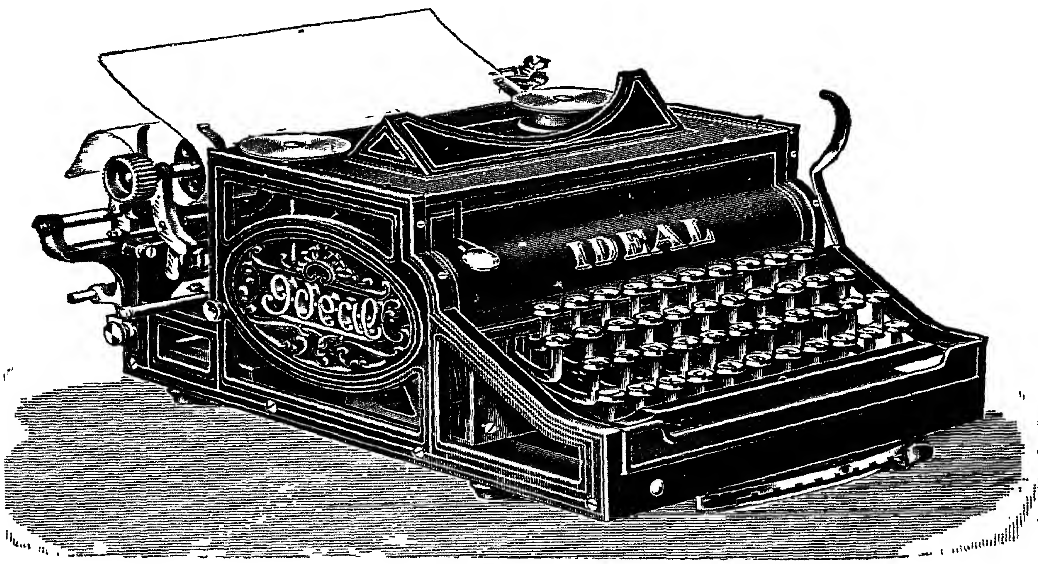


FIG 165

an additional charge. In designing the Ideal as a visible writing machine, the makers sacrificed nothing to obtain this important result, and carefully embodied all well tried principles of construction. Minor details, such as type-bar lock, marginal release, etc., are incorporated in the model. At the end of a line, the carriage is returned by means of a long handle shown just above the keyboard.

Kanzler. This machine is manufactured at Berlin, and possesses the singular feature of being the only typewriter manufactured in Germany in its own factory, all other German made machines being produced in factories devoted mainly or in part to other products.

FIG 166

The Kanzler is a visible writer, but is built upon an entirely novel idea, since eight characters are arranged on each type-bar This necessitates the use of only eleven bars to carry the total of eighty-eight characters. The peculiar form of lever used may be gathered from the annexed illustration, and the object sought in the adoption of this form of bar was to reduce the distance of travel of each type-bar, and so gain speed in operation.

Kochendorfer, K. H. A type-plate machine.

Kneist. The invention of Messrs. Meyer and Funcke. It bears great resemblance to the Graphic, but does not appear to have found its way to these islands.

Livock and Hermann. A machine embodying on a new plan of type-bar, which has, however, not yet found its way to the market.

Mahron. A type-cylinder machine, employing a key-board, and a type-wheel or sleeve in which the characters were arranged in six rows. The types struck flat on top of the platen, and the writing therefore would have been in full sight had the machine ever been made.

Polygraph Typewriter. This machine is made by the Polyphone Musickwerke, of Wahren, near Leipzig, Germany, and is possessed of several very interesting features.

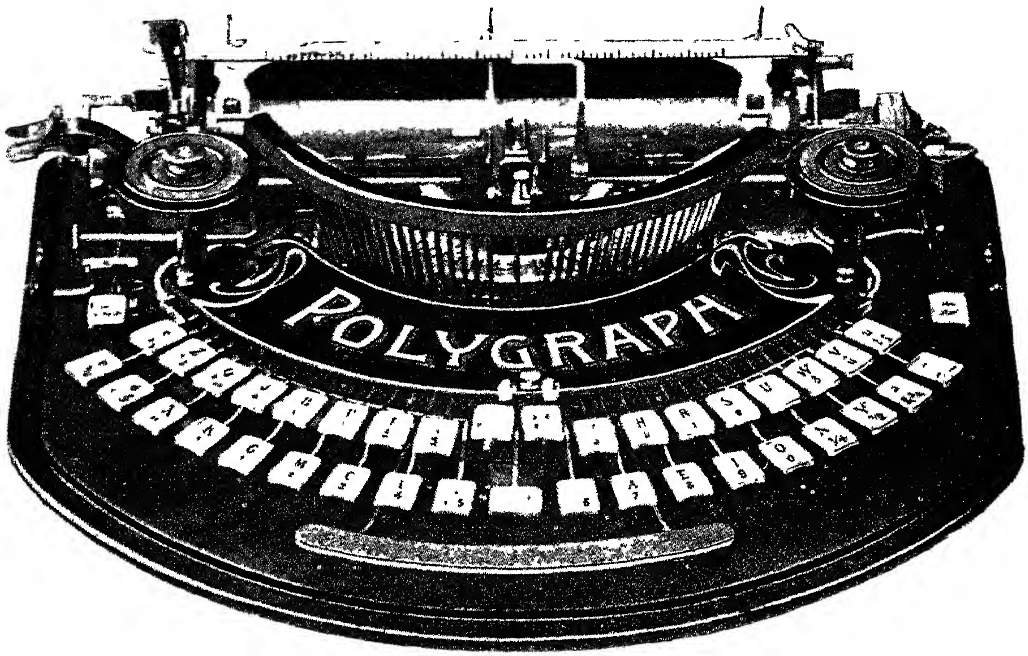


FIG 167

Two distinct models have been made, one of which adopts the square universal keyboard, and the other the Ideal-Hammond keyboard. The types are mounted on the ends of bars, which stand upright and strike down to the platen away from the operator (as in the Bar-Lock) but there is no screen between the eye of the operator and the moving type-bars, so that the effect to weak eyes may possibly prove to be very trying. The machine works with a double-shift key, and the inking is effected by means of a ribbon, and it will be noticed that the whole scheme of the ribbon-gear seems to have been incorporated bodily from the Hammond machine. The great point to be considered, however, is, does the machine do its work? and to this an entirely favourable reply must be given. The movement is easy, quiet, light, and very rapid, and the impression clear and powerful.

Our illustrations show front views of models 1 and 2, and a back view applicable to both. In addition, a new model of the No. 2 is made, in which the number of characters is increased from ninety to ninety-six, and this great range

FIG. 168.

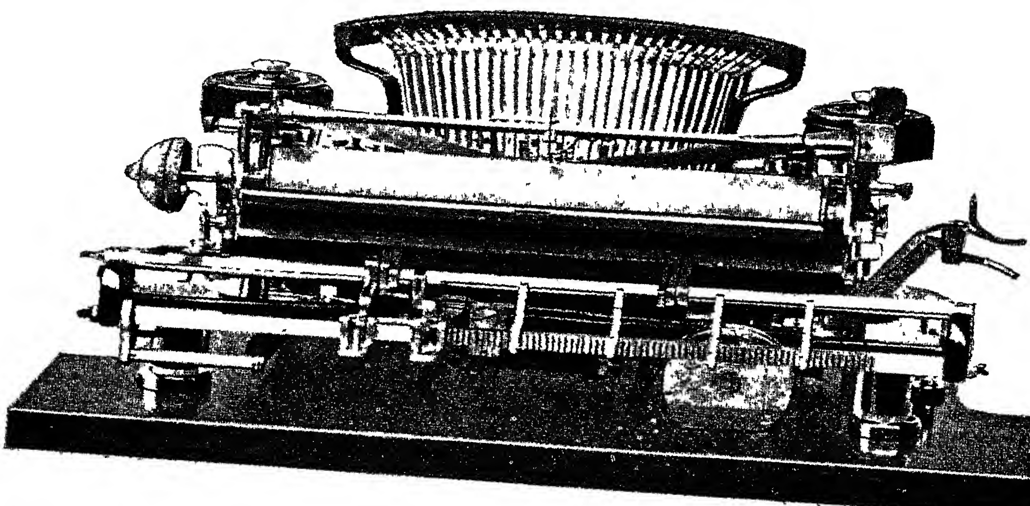


FIG. 169.

of type, permitting as it does, of accents and special characters being supplied to meet the requirements of French and English, in addition to its native German, gives the machine the right to assume the title of Polygraph. The elevated scale over the platen will be especially noticed. This resembles the device in the No. 7 Blick, but is it a good one ?

Regina. This machine claims to incorporate all the good points of other machines ; without, however, possessing any distinctive feature of its own, saving that it is very well finished, and is made of the very best materials throughout It is fitted with a Tabulator, and the carriage runs very freely on ball bearings. The circular opening in front of the machine is closed by means of a name plate, thus guarding the type-bars from dust, and preventing the eyes of the operator becoming tired by the rapidly moving bars. The plate can, however, be instantly removed for type-cleaning purposes. It is a £20 machine.

Schade's Schreibkugel (writing ball) resembled in theory the instrument of Pastor Hansen, just noticed.

The paper was gripped between rollers and remained stationary, the operative part travelling along as the line of writing proceeded. No less than eighty-four keys were arranged over a convex-shaped top-plate, and the machine was fitted with a copy-holder, line pointer, and many other accessories. The inking was accomplished by a ribbon, and at the end of a line the entire movement had to be returned bodily, whilst to examine the work, it had to be turned back on a hinge just as one throws back the lid of a box to examine its contents.

Soblik. This machine, named after its inventor, a Civil Engineer, possessed the features of visible writing, silence, and was driven by pneumatic power. The air-supply was afforded by means of two small pumps placed under the machine, and worked by the feet. The types were placed on the periphery of a wheel, which constantly rotated at a great speed, making in fact, ten turns per second. The machine does not appear up to the time of writing to have been commercially handled.

Stoewer. A very popular machine built on the front strike principle. The makers are Bernhard Stoewer Actien-Gesellschaft, of Stettin-Grunhof, and the machine, so far as outward appearance goes, more strongly resembles the Underwood than any other.

It will be observed that it has four banks of keys, and works with a single shift-key. The front plate is hinged,

and is opened out by the depression of a lever at the right of the framework. The margin stops can be arranged from the front of the machine, the vibrating ribbon carrier also serves as a type and aligning guide, and in all other respects the usual devices are incorporated in the Stoewer, which seems to be most substantially built, capable of doing all that is required of it, and a machine which forms a very serious rival, in Germany, to other instruments of trans-atlantic origin.

A very special feature deserves notice, namely, that after a key has been depressed the type will leave the printing point and return to "rest," without raising the finger from the key.

The machine illustrated is an edition or variation of the Stoewer which was placed upon the English market under the name of the "Swift." In this machine a number of changes are made. The shift key is in duplicate, but in order to lock for all capitals, it is necessary to

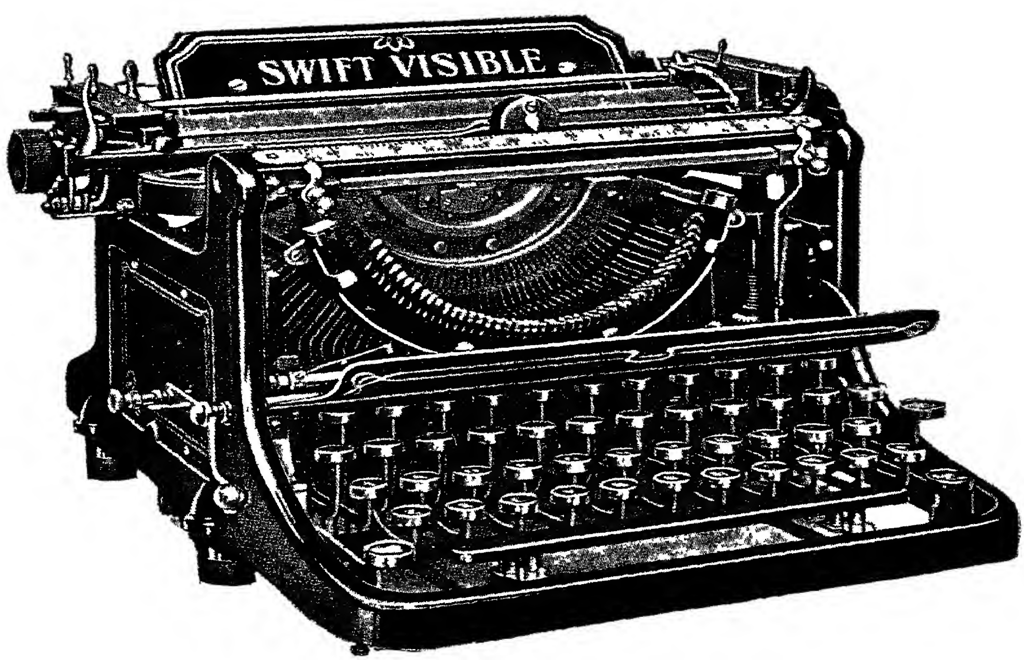


FIG. 170

pull over a small lever at the left of the machine. There is a back space key, and a tabulator, passing from point to point, eight stops being provided with the machine. The writing line is long, covering as it does eighty-seven characters. The carriage release is in duplicate, the change of line space is very simply effected. There is a feed roll release to permit of the insertion of a number of sheets, and the regular line spacing may be immediately thrown out of gear to permit of writing on ruled lines, etc. The ribbon is not reversed automatically, but requires the pulling in or out of the shaft governing the ribbon feed. The writing is certainly in full sight, the machine is a very fair manifolder, and taking it all round it is a reliable instrument. We also illustrate the type-bar movement of the "Swift."

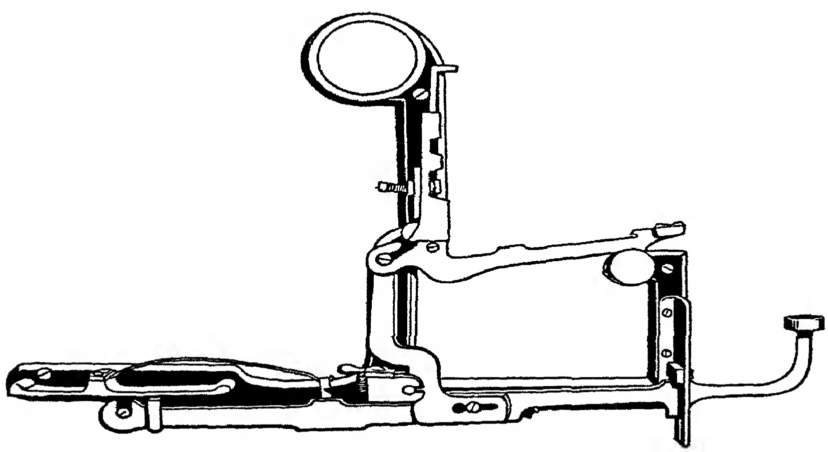


FIG. 171

Stolzenberg. The continental name of the Oliver Typewriter. So called from the Stolzenberg File Co., who had the European representation of the machine. In 1906, however, a special company was formed to exploit the machine, which appears to be making marvellous headway throughout the continent.

Stander, E. A German type-bar machine of the first group. It never reached the commercial stage, but its chief peculiarity was that it had only eight keys, means being provided, by the agency of moving the carriage, to ensure the desired character being brought to the printing point.

Volks-Schriebmaschine. A very simple index machine issued by Fritz Rehmann, of Karlsruhe, in Baden.

Westphalia. Among the typewriters of foreign invention was the Westphalia, invented by Mr. E. W. Brackelsburg, of Germany. On this machine it was said that all modern languages could be written, the alphabet consisting of eighty-six characters, including the French accented vowels. No ribbon was employed with this machine, but a paper coloured on both sides was placed over the letter, and over this a thinner sheet of paper was placed, so that the print could be seen. In this way it was claimed that ten or twelve copies could be taken at one writing. The machine, however, has scarcely been heard of in England or America, and if manufactured, its sale was confined to the local part of Germany in which it is manufactured.

Mercedes. This machine, which has its head quarters at Berlin, is a very fine piece of workmanship, and is, as the illustration shows, built on the front stroke plan. A great feature is, that by the loosening of a couple of screws,

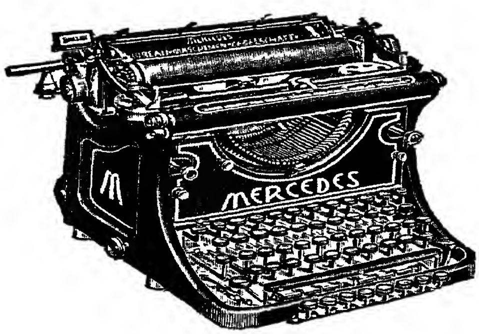


FIG 172.

the whole of the keys, levers, and typebars may be brought away, and a different style or size substituted, so that, in a way, the machine may be said to have interchangeable type. In this it follows the Daugherty, and others of its type. The machine is fitted with a tabulator, and a device for indicating the approach of the "letzte zeil" or last line of writing—a very useful adjunct to the machine. The makers have taken every care to provide a complete and thoroughly practicable instrument, with, we believe, more than the usual amount of success.

The Norica Typewriter bears, it will be noticed, some slight resemblance to the Triumph, since the typebars which, when at rest, stand nearly upright, strike down to the front of the platen. The machine has forty-five keys, governing ninety characters, worked with a single shift key. It embodies most of the conveniences of modern typewriters, including a back space key, and the line spacing gear is easily thrown out of action to permit of writing on ruled lines. It employs a narrow ($\frac{7}{16}$th) ribbon, and its weight is about 16 ks.

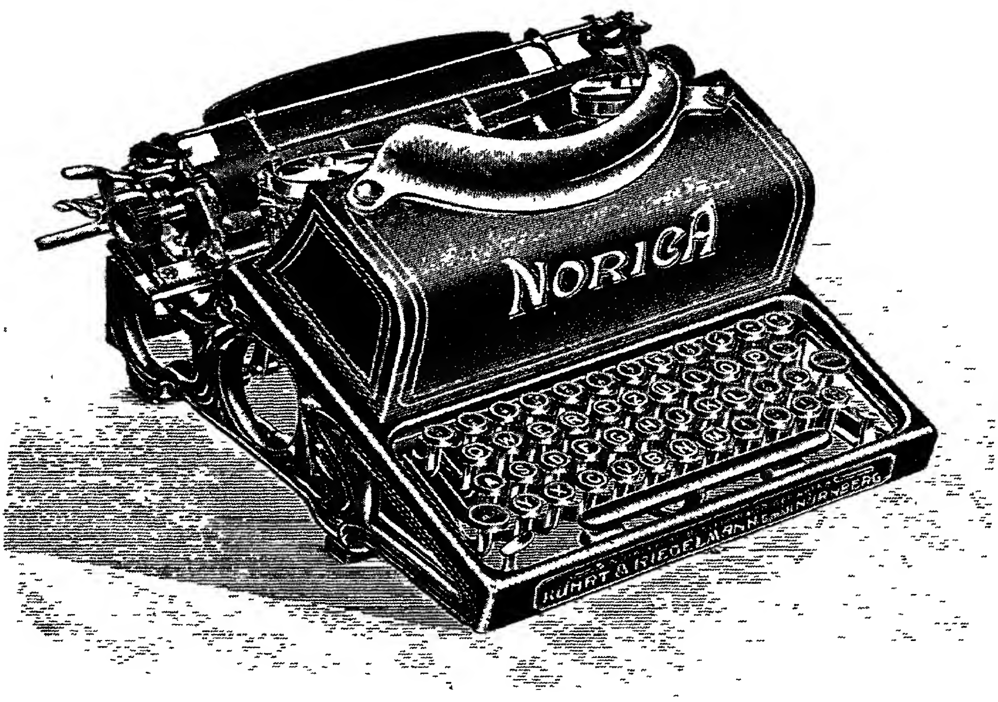


FIG 173

The Saturn. This machine illustrates a very ingenious device for a low priced typewriter. It will be seen that the types are engraved on a wheel and that a row of nine keys occupies the front of the machine. At the back of the keys is an index plate having five lines of characters, each row having nine letters to correspond

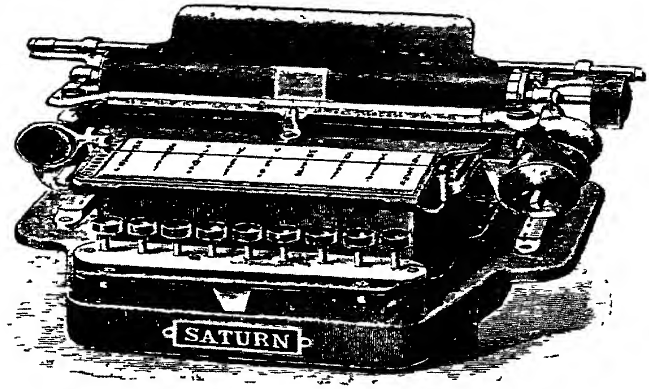


FIG 173A.

with the keys in front. By working another key at the left of the index plate, the wheel revolves so as to bring that particular row of keys into focus, and the exact letter is then printed by striking the corresponding front key. Means are provided for shifting to capitals, etc. Of course, all this involves two operations every time a character is struck, but by a proper arrangement of sequences, and a little practice, a very fair speed might be attained. We believe, however, that the machine was never made commercially.

Torpedo. This is a very substantial machine of the front strike variety, and is manufactured at Frankfort on the Main. It is fitted with forty-two keys, governing eighty-four characters by means of a single shift key. Inking is effected by means of a ribbon, the movement to right or left being varied by means of a lever in front of the machine, just to the left of the name plate. By placing this lever centrally, the ribbon is thrown out of gear, for stencil work, etc. The platen is easily removable, and so is the whole carriage, whilst the paper feed is good and regular. Following the plan now so often found, the margin stops are placed in front of the machine, and can be readily adjusted, or varied in position for the insertion of marginal notes. Means are provided for writing "sperrschrift," i.e., s p a c e d o u t, and many other little conveniences are incorporated in the Torpedo. Two coloured ribbons may be used if desired. Moreover, the

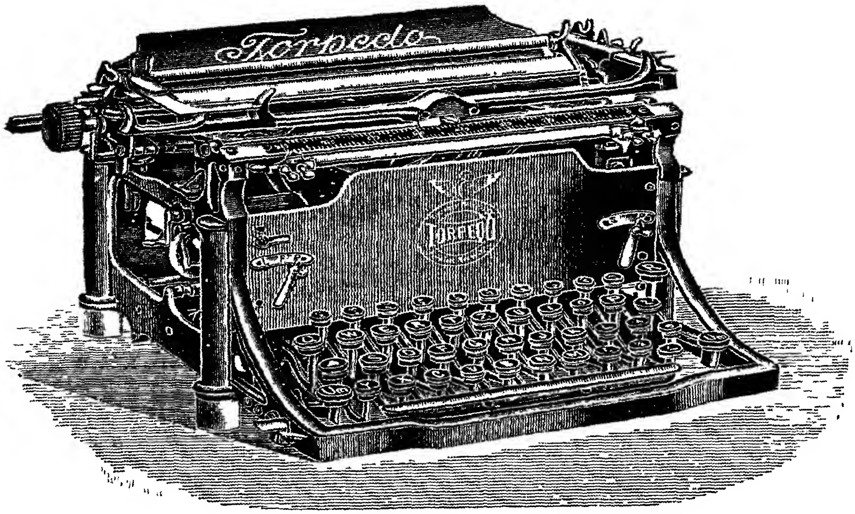


Fig 174

type-bars may be easily and conveniently taken out of the machine either for repair or substitution, and there is a secret lock to prevent interference with the machine when left unattended.

CHAPTER X.

Index Machines.

ALL the time that the typewriter was making a name for itself, there was an undercurrent of simpler construction at work, which sought to popularise by cheapening. These machines were termed "one hand" or "index" machines, but in view of the immense strides made by other inventors on standard lines, whereby keyboard machines were made at prices little if anything in excess of that charged for index machines, the latter gradually died out.

By the mere nature of things, no "index" machine can for a moment compete with the keyboard machines in the matter of speed, but it must be confessed, if speed be eliminated from the comparison, many of the index machines are capable of turning out work fully up to the standard of beauty as presented by the best of the larger makes.

The general principles upon which the index machines are based, may be stated briefly, as follows: The types are usually cast in one piece, either on a strip of rubber or metal. By means of a pointer they are brought over or opposite the printing point, as denoted by a printed slip or index in front of the machine. This having been found by one hand, the other is used to depress a lever, which either causes the type to move towards the paper, or the paper towards the type. The inking is generally effected by means of a small ink roller (or two), which continually presses against the type slip. According to the manner in which the types are formed, index machines may be divided into four groups, viz. :—

(*a*) *Typewheels* (as Columbia, Simplex, etc.)
(*b*) *Type Slips* (as Odell, Sun, etc)
(*c*) *Type Plates* (as Hall, Century, etc.)
(*d*) *Movable Types* (as Merritt, Ingersoll, etc.)

The machines using type-slips include several which have attained a considerable amount of popularity. More particularly is this the case with the Odell, the Globe, and the World machines. In each case the types are cast in one piece, and are mounted on the edge of a movable bar, either straight, as in the Odell and Sun, or forming the arc of a circle, as in the Globe and World. In the former case, the types are moved along bodily ; in the latter, the arc ends in a long handle, so that a rude resemblance to a fan is made. This being pivoted near the middle, the movement of the handle over the index plate causes the types to perform a corresponding and simultaneous movement ; but, of course, in a reverse direction. The depression of the printing key then causes the impression to be made. In each case the inking is effected by means of small ink rollers, which can be kept supplied by a few drops of the ink used for india rubber stamps.

All the machines using type plates died young, with the exception of one. The one was, singularly enough, the first one of the class that was launched, viz., the Hall, which has, however, now joined its companions. The principle upon which the type-plate machines operated may be stated thus: The types are cast on a small plate of rubber, about two inches square. This plate is mounted on a metal shield by means of two small screws, and may, therefore, be removed for cleaning or to change the style of type. The shield is capable of being moved backwards or forwards in any desired direction, by means of an ingenious arrangement of metal slips. The pad rests face downward on an inking surface in the centre of which is a small hole. On top of the machine is an index plate, and a pointer is pressed into an opening corresponding with the letter desired. As this pointer is attached to the type-plate shield, the latter carries the type with it in such a way that, when the pointer is over the letter desired, the letter is over the hole in the inking surface, and ready to drop down on to the paper below. Pressure then causes the apparatus carrying the inking surface, type, index, etc. to fall, and, the projecting type striking through the hole, leaves its mark on the paper. The paper does not move, but the type moves along across the surface of the paper.

The American $5 Machine. This instrument was placed on the market in America a few years ago. It found its way into this country under patronage of the Globe

Investment Trust in the middle of 1895. It was then remodeled, made in a superior manner, and offered for sale at forty-five shillings under the name of the Globe.

In this instance the types extend to seventy-two characters, including capital and lower case signs, figures, punctuation marks, etc., and are cast upon a thick slip of rubber, and are mounted in an upright position on an

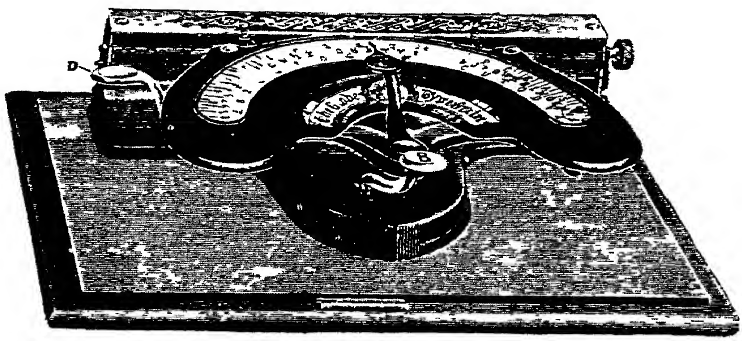


FIG 175

arc the position of which is shifted by means of an index. When the index is brought over the letter it is desired to print, a printing key is depressed. In the brass arc carrying the type slip are a series of small holes, corresponding in position with the letters on the rubber. When the printing key is depressed a pin enters the proper hole, and locking the type against side play, secures each letter printing in its proper place. Simultaneously with this a small hammer presses against the inside of the rubber and so forces the character, which stands in prominent relief, through a slot in a brass guide plate, and so causes it to imprint against the paper. The escapement is similar to that of the Blickensderfer. The Globe with practice will yield thirty or forty words per minute.

Coffman. This was a very cheap instrument emanating from St. Louis, Mo., U.S.A., and the price $5 (say £1 1s.) will about represent its value. The type were cast on a strip of rubber, the selection and printing of any character being effected by means of a pointer. Its dimensions were 9¾ ins long, 2 ins. wide, 2½ ins. high, and its weight was less than 20 ounces.

The Columbia. This ingenious machine paved the way for the more ambitious effort of its inventor, Mr.

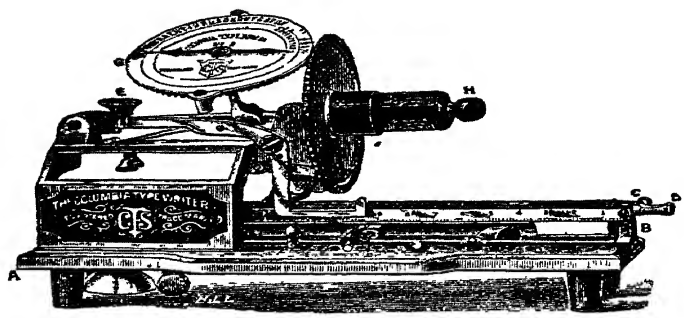


FIG. 176.

C. Spiro, which is known as the Bar-Lock, and which was described at length in Chapter IV. The Columbia was introduced in 1885, and has taken a number of medals for general portability and adaptability. It was made in two styles, the No. 1 having forty-four characters and writing capital letters and figures only, the No. 2 having seventy-two characters, including upper and lower case letters, numerals, etc. It consists of a wooden base nine inches long, three and a half inches wide, and the height of the machine is about seven inches Mounted on a suitable standard are two wheels, one of which is perpendicular, and the other horizontal. The two are connected by cogged teeth.

The perpendicular wheel carries the type on its periphery, and is revolved by means of a knob until an index hand on the face of the horizontal wheel points to the letter it is desired to print. A downward pressure on the knob causes the impression to be effected. The Columbia gives a differential or "proportionate" spacing, and prints direct from the type, which derives the ink from a small moving ink pad. The Columbia is undoubtedly the best of this class of index machines.

The Champion. The Champion is a "pointer" machine. Its general appearance is not unlike the Hammond on a small scale. It has a type-wheel in a horizontal plane, by the rotation of which the characters are brought to the printing point. The rotation is effected by the movement of a pointer by the forefinger of the right hand over an index plate. When the pointer is over the desired character, a thumb lever is pressed, and the paper thus brought into contact with the type. A ribbon is the inking device, in which the Champion differs from most pointer machines. It is said that forty words per minute have been written with it.

The Crown. This machine is the invention of Mr. Brooks whose other machine, named after himself, we have already dealt with. It was placed on the market in 1888, and has its types arranged in three rows of twenty-seven each on the periphery of the wheel. The wheel strikes the

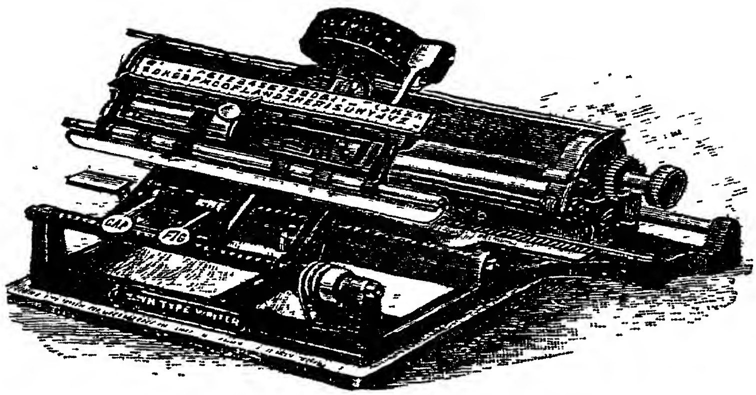


FIG 177.

platen in a manner somewhat resembling the Blick, and the inking arrangements are also after the same description. The type-wheel being of metal, and the platen of hard rubber, manifolding may be easily executed on the Crown. The type-wheels were interchangeable, and several varieties were procurable.

The Century. This is an instrument using a pointer, on the Hall principle, and is also the invention of Thomas Hall, of New York, whose first invention was described in our first chapter, page 33. Using a type cylinder with ten rows of type of ten characters each, making one hundred

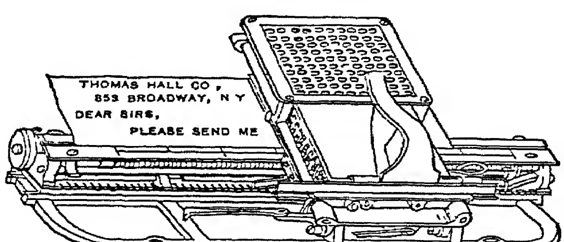


FIG 178.

characters, this form allows the greatest number of characters to be embodied in a very small and portable instrument. The cylinder is rotated by a rack fixed to a sliding handle operating a pinion at end of the type cylinder. The frame in which the cylinder is held slides in the frame to which

the index is fixed, the cylinder pinion rack and pointer handle all sliding together up and down on the index frame, so that any one of the one hundred characters can be brought to the printing point by simply moving the pointer in the most direct course to the corresponding character on the index. In this instrument the paper carriage moves and the printing mechanism remains in one position over the paper, only having a slight movement up and down to make the impression. The inking is done by a felt cylinder saturated with ink rolling in contact with type on type cylinder. The paper is held by two small rollers geared together. The platen is a flat metal surface just above and back of rollers.

Edland. In this machine, which was made by the Liberty Manufacturing Co., of New York, the types were cast in metal and attached to the periphery of a revolving wheel (which was easily interchanged) so that on the turning of a handle the selected letter was brought opposite the printing point. Pressure on the handle also tilted the wheel, so that the type was brought in contact with the paper A bell denoted the approach of the end of the line. The inking was by means of rollers, and the repertoire of the Edland was seventy-eight characters.

Eureka. This machine (which appears to be also sold under the names of the Practical and the Simplex), is made in several sizes, selling from 5/6 to 25/. It is more in the nature of a scientific toy than a typewriter, but it can do fairly decent work. A revolving disc is mounted, having a series of notches at the edge, under which the types are placed. The disc is twirled by means of a knob, and when the selected letter is over the printing point, it is pressed down to the paper, which is gripped between two rollers in the higher priced machines, or metal strips in the cheaper ones.

The Eggis Type and Cipher-writer. This was an index machine launched in London a few years ago. The types were formed on the rim of a large circular plate which was revolved by means of a central pivot. Inking was effected by a ribbon. The "Cipher" part of the machine simply consisted of varying the position of the plate. The machine was made to sell at eight guineas but proved to be a commercial failure. A few examples may be found occasionally and are worth buying—if very cheap (say a few shillings)—as curiosities.

The Gynee. The name of this machine appears to be another way of spelling guinea, at which price it

was offered for sale. Its general principles resembled the Simplex, but it presented a dial plate and other features. It is a pretty toy.

The Hall. It would be almost impossible to say how many thousands of this machine have been sold. No machine is, or ever has been supplied with such an infinite variety of type. A specimen book before us shows type in

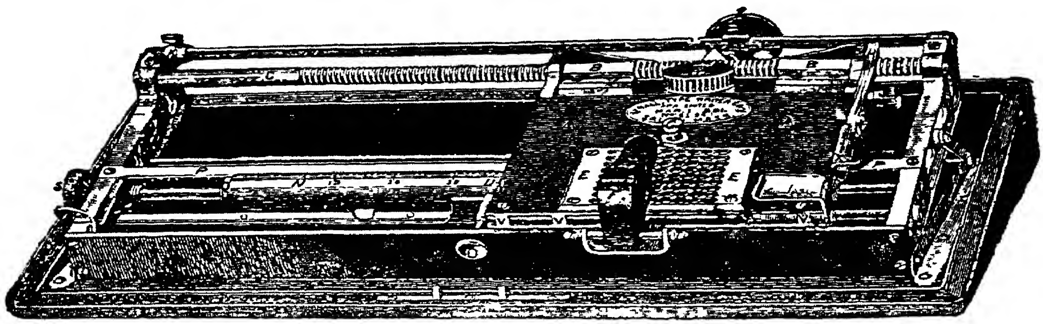


Fig. 179.

every European language, besides Hebrew, Hindustani, Sanskrit, Urdu, Arabic, and very many others. The Hall packs up into a very convenient box, and is, without doubt, one of the most useful of index machines. Its general principles are similar to those of the Morris.

The Herrington was placed on the market in New York in 1886. It is the same machine as the Simplex.

The Ingersoll. This, as a typewriter, is beneath notice; as a toy, it may be mentioned. A series of blocks, each carrying a character, are strung through with a metal rod, which is bent in the shape of a double C. This rod

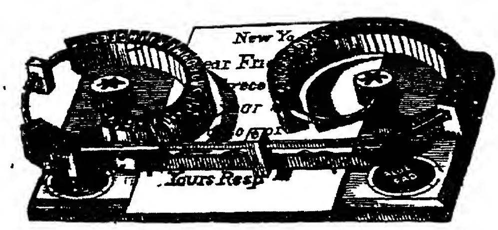


Fig. 180.

is supported on a base board at the corners of which are ink pads. The paper is laid (straight if it *is* straight, crooked if *not* straight) on the base board, and the blocks slid along the rod, pressed down to the ink pad, and then pressed on to the paper. The "contraption" might suit a child learning to spell, and that is all.

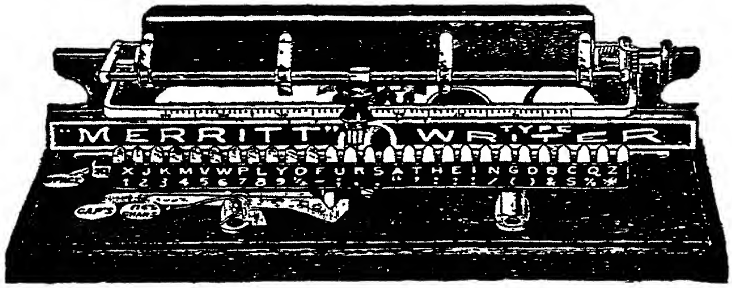


Fig 181.

The Merritt. This is a very stately, very ingenious, and thoroughly workable little instrument. The types are of metal, each piece being separate, and are mounted in a suitable holder. Over the types the paper rests in a movable carriage which is hinged, and appears to have been suggested by a much more elaborate machine. In front of the machine will be seen the index plate, and when it is desired to print, the handle (shown in the centre of the illustration) is moved along until it is over the notch corresponding with the desired letter. It is then pressed down, and the type rises in its holder, and passing through a centre guide (identical with that on the Yost) strikes the paper. The capital and figure shifts, and the space key, are shown by the cut. Inking is effected by means of two small rollers placed beneath the carriage, and which can be instantly changed. In many ways the Merritt is the very best of the index machines.

Morris. This instrument was manufactured by the Hoggson & Pettiss Manufacturing Company, of New Haven,

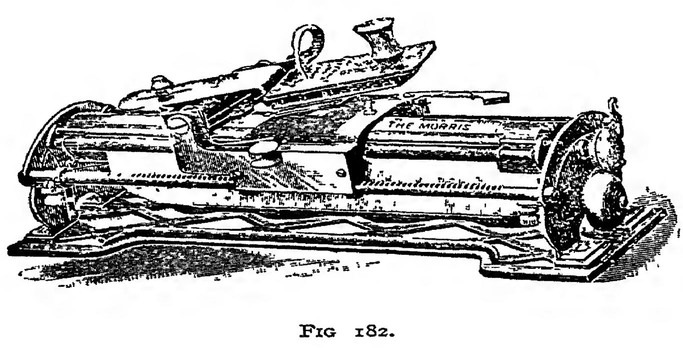


Fig 182.

Conn., and was patented January 11th, 1887. It is a single-case machine, printing only capital letters, figures and punctuation marks. The keyboard, containing forty-five characters, is shown upon the movable type-plate

on top of the machine, the character required to be printed being brought directly under the pointer above, when the knob is grasped by the right hand and depressed, and the printing is done by means of a rubber type-plate below, upon the platen which holds the paper. The Morris prints from the face of the type, much after the manner of the Hall, no ribbon being required The types are moulded on the end of the rubber posts, or pillows, and these are held in their relative positions by a perforated metal plate which is exact, and brings each letter to the line, rendering it impossible to print out of alignment. The machine weighs 4½ pounds.

Mercury. This machine, although classed in the

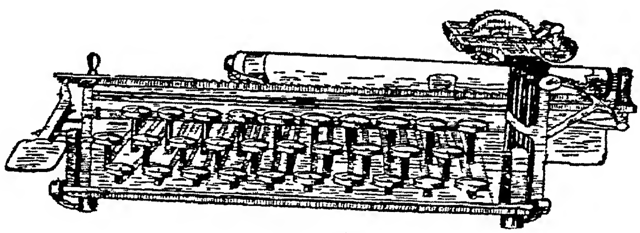


FIG 183

index section as a matter of convenience, really occupies a midway position between ordinary keyed typewriters and those of the index variety.

It was an ingenious and altogether remarkable attempt to make the most of each idea, since a complete keyboard working with a double shift was provided, the order of the keys being according to the standard arrangement. At the same time the impression was made by means of the impression key at the left of the keyboard.

The type characters were engraved on the periphery of a wheel which slid along on its axis when the shift-keys were used. The movement of the letter keys was transmitted to the typewheel by means of a toothed rack. This rack was geared to a similarly geared wheel attached to the typewheel, and as it rose more or less according to the key operated, the wheel performed a corresponding rotation. When the selected letter faced the printing point, the depression of the printing key caused the impact.

Inking was effected by means of a moist ink roll, which pressed constantly against the typewheel. The paper fed round a cylinder, mounted on a travelling carriage in the usual way.

McLoughlin. This machine was placed on the

market in 1884 by McLoughlin, Bros., toy dealers on Broadway, New York, but has long since been withdrawn from the market. A description, printed at the time, is as follows :—" It is on a wooden base, is about twelve inches long, six inches wide, and five and a half inches high, weighing four pounds. The printing apparatus is in a carriage sustaining several discs, the lower of which rotates, and around its edge are the characters used, a single alphabet, figures, etc. They are electrotyped from printers' type. On the upper disc is a card printed to correspond with the signs below. A handle connects with a post running down to the type disc, which turns responsive to action on the handle. The edge of the upper disc, about the dial card, is raised and notched opposite the several characters, and the printing is accomplished by putting the handle in one of the notches and pressing down. The entire carriage falls, being hinged on the front horizontal bar, and held up by a spring which returns it from each impression. When the carriage is pushed down, a ratchet in front acts and moves it along over another space. This ratchet is released, when desired, by the hand, and the carriage put at any point on the line. The paper is inserted over a leather-covered roller at the back, and held by a clip of metal, moving forward a line by a turn on the button at the left end. The ink is supplied by small felt rollers held against the line of type on the under disc.

The Miniature. A half-guinea machine, put on the market a few years back. It consisted of a circular piece of flexible metal, the edge being cut into tongues, on the underneath sides of which were the types. It was intended as a pocket typewriter, and could easily be got into the coat tail pocket. Need we say more !

The Niagara. This is a pointer machine made by the Blickensderfer Company and put on the market by them. It has the Blickensderfer carriage and typewheel, and the makers claim it will manifold and cut a good stencil. Of course it is slow, but it will give a speed equal to any of the other pointer machines.

The Odell. In this machine the types are of metal, cast in one piece, and travelling in a suitable holder across the top of the machine. This holder is attached to a swinging frame, which moves downward when the depression is made. The type travels over the moist ink roller, and, on depression of the index, causes the printing to be effected. At the same time a small lever, at the end of which is a pawl, moves forward the space of a letter, and, on pressure

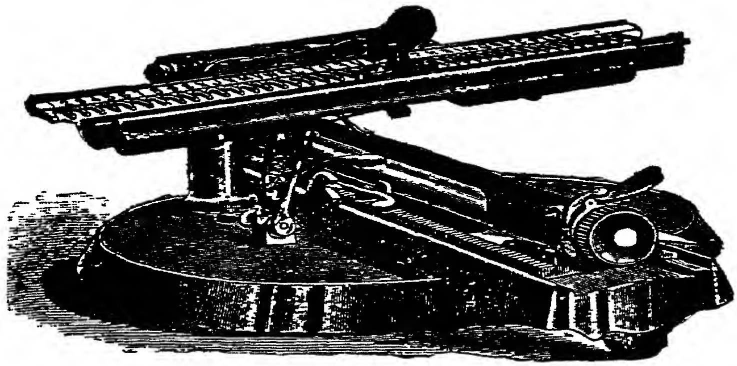


Fig 184.

being released, the typeholder frame moves along a corresponding distance. Line spacing, warning bell, margin stops, etc., are simple and effective. An indicator points to the spot where the next impression will be made. There are two styles of Odell, one with forty-two characters, the other having seventy-eight letters—capital and small—figures, etc.

On the first introduction of the Odell, it was sold for six guineas. It then fell to three guineas, and finally, on Messrs. Perry (who were the agents of the machine) giving up the retail trade, it was reduced to a guinea. The machine is still manufactured by the American Company of Momence, Ill., who are seeking agents in many quarters.

Philadelphia. A typewheel machine, to exploit which a company called "The Philadelphia Typewriter Company" was organised. The type was engraved on the periphery of a wheel, in a horizontal plane, mounted on an upright post, and the impression was made by means of a hammer, or rather a piston, which drove the paper into contact with the type. In this respect, therefore, the Philadelphia bore, so far as the printing mechanism is concerned, some resemblance to the Gardner Typewriter, already explained.

Pearl. An index machine formerly made in America. The types are arranged on a wheel, mounted on a post, before the carriage. The movement of a pointer is communicated to a twirler arm, which, geared into grooves on the post, causes the latter to revolve, carrying with it the typewheel. The machine is not now made.

The People's Typewriter. This is the invention of Mr. E Prouty, and hails from Chicago. We have one before us as we write. The types are arranged in two

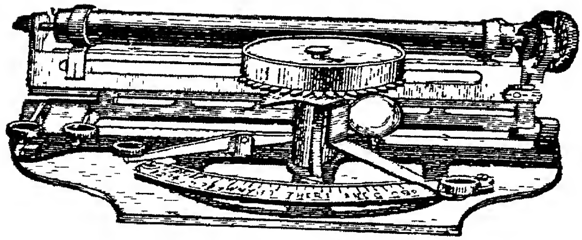
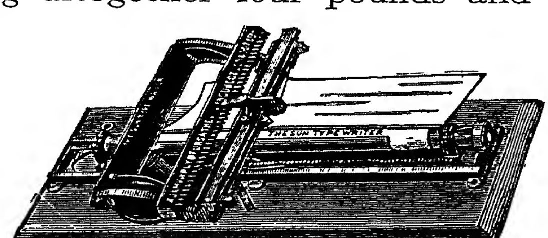


Fig 185.

rows on the periphery of a metal wheel, which revolves on a post very similar to the Hammond. Below the type-wheel is a cogged wheel, the teeth of which engage with those on a twirler suitably pivotted. At the end of the twirler is a long arm, and when the extreme end of this arm is brought against the desired letter on the index plate, the corresponding type faces the printing point. An impression key is then depressed, and the carriage swings towards the type, thus making the impression. The type is locked during the act of printing, by means of an arm entering the teeth of a wheel below the type-wheel. Inking is effected in a very curious manner. Over the type-wheel is laid a metal ring round which is attached a piece of ordinary typewriter ribbon This ribbon (which can be moved and replaced in a moment) thus surrounds the type and hides it from view. Swinging loosely, its movement does not coincide with that of the wheel, and the result is that fresh surfaces are continually presented, and good impressions maintained.

The People's typewriter undoubtedly presents considerable food for thought for those who desire to produce a simple form of machine. The ribbon gear appears to have been afterwards improved, and the machine then became the Champion already described.

Sun. This instrument was put on the market in New York in the fall of 1884 The apparatus is on a wooden base, weighing altogether four pounds and a half. It is



The "Sun" Typewriter.

Fig 186

twelve inches long, eight wide, and three and a half high, and holds paper eight and a half inches wide. Impressions are direct from the characters. An iron post holds the frame, seen extending from front of this frame is a series of teeth ; above and opposite the interstices between these teeth being displayed the characters in use, as may be plainly discerned in the cut. In front of the row of teeth is a groove, hinging at the back of the frame, holding a slide, and being perforated at several points on its under-side. On the bottom of the slide is a row of characters electrotyped from printers' type, corresponding with those shown on the frame, as referred to. Attached to the top of the slide is a casting projecting over either side, affording finger hold on the right end, and on the left being filed to a knife edge beneath.

The slide works back and forth by application of the fingers, and the knife edge ranges over the teeth. The paper is inserted behind a kid covered roller, and held against it by a metal clip in front and a wire above. It moves backward or forward by action of the fingers on the button shown at the right end. The roller stands on a simple frame, in ways, and having a ratchet connection in front with the frame above. Ink is supplied from several small felt rollers held at the perforations under the type slide. Printing is effected by depressing the groove, when the knife edge passes between the teeth under it and opposite the selected character, which appears at the perforation under the type slide over the roller and impresses. The bearing down on the groove acts as the ratchet connection, moving the paper a space to the left, and the groove is lifted by a common spring. But one alphabet is used and one style of type.

The Simplex. This was a very paltry invention, launched in London some years ago. It consisted of a brass wheel mounted perpendicularly on an upright post. Attached to the wheel was a slip of rubber, having the characters cast on the face. The pivot of the wheel passed through a slot in the post, and was pulled upward by means of an indiarubber band. The wheel was revolved by means of a small knob, and then forced downward on to the paper. Capital letters only were printed. The inking was by means of a small ink roller. The price was 10s. 6d. The stock passed, on the collapse of the company, into the hands of fancy dealers, who sold the machine at 3s. 6d. A Simplex is now being advertised at 12s. 6d., but we do not know whether it is the same machine.

The Victor. This is a very good example of the present class of machines, and is strongly made and well finished. The types are mounted round the edge of the large central wheel, which rotates by means of the toothed

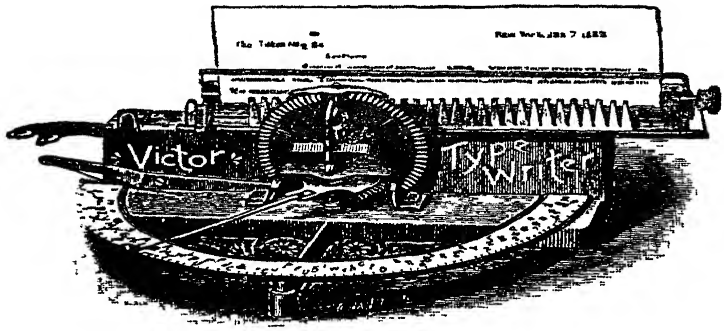


Fig 187.

gearing at the far end of the index bar. The inking is by means of pads. The general operations are about the same as in all other specimens of this group.

The World. This machine is the invention of Mr. John Becker, of Boston, and has had a career of some ten or eleven years. It is the first cheap machine to meet with any considerable amount of favour, and it is said that within a year of its introduction upwards of 17,000 machines were placed on the market.

Fig 188

The types are of vulcanized rubber, and are mounted on the underneath side of a semi-circular plate, the types deriving their ink by passing over an ink pad at the rear of the machine. The general manipulation is identical with all other machines of this class.

CHAPTER XI.

Supplemental Notes.

THE foregoing descriptions present a very clear idea of the position of the Writing Machine, but there has been a very large number of which the record ends with the patent specification ; whilst others have been actually made, and some have even got so far as to reach the market ; where, not always from their own defects but sometimes, it may be, from popular neglect, they have failed to justify the hopes of their sponsors. They deserve a record, which we give.

This record will also enable us to mention many special or exceptional machines as well as a number of other points and items of interest, particularly to identify machines which have been issued under varying names in different countries. In dealing with these machines, we have taken every possible precaution to ensure accuracy, but it is obvious that in this, the first attempted complete account of its kind in the English language, although we have set down naught in malice, there have been numerous opportunities for errors to arise. If such there be, we shall at all times be glad to hear of them ; whilst should any reader consider too much attention has been given to those machines which have ceased to exist, we can only say that our motto throughout has been

De mortuis nil nisi bonum.

Addey's Typograph. This machine was announced in the papers about the year 1889, but it does not appear to have been manufactured commercially.

The main feature of the instrument consists in having the letters placed around a small ball or sphere, 2 inches in diameter, which is caused to revolve. The letters themselves are ranged in six lines converging at the poles. When it is desired to print a certain letter the inking roller passes over it. Then the platen presses the paper against the

whole bank of type, but, of course, only the letter which has been inked will leave an impression. The platen immediately falls back and exposes the printing to the full view of the operator.

The Typograph has thirty-six keys. They are ranged in three banks, squarely before the operator like the keys of a piano. In the centre of the keyboard are two shift-keys, a spacer, and a reverse spacer, this latter being in itself an entirely novel feature. Although the Typograph has only thirty-six keys, it is capable of printing 118 distinct characters, a large increase on ordinary typewriters. This result is due to the construction of the machine, which allows each key to act upon three different characters. By combination other and different characters, including all typographical and commercial marks, can be made. So also can fractions, as low as eighths, and accented letters. This latter feature makes the machine available for foreign languages. If two keys are struck together on ordinary typewriters the result is a clashing which is apt to put the machine out of gear. With the Typograph it is not so. The stroke either becomes inoperative, or else one key gives way to the other.

Mr. Addey called his machine "portable," because it weighed only twelve pounds. Its dimensions were as follows: height, six inches; width, ten inches; and length, fourteen inches. It was comparatively simple in construction, and did not consist of more than 200 parts.

1876 **Allen: R. P. T.** A patent was issued to this gentleman, but the machine was never put on the market.

The Scientific American, in explaining the machine, says:—

"In Allen's machine, the carriage is moved back for a new line by means of a cord, pulley and weight, the last named sliding in a suitable casing at the inside of the frame, and in the other direction by a cord and button, the weight serving in connecting with a double paw to move the paper laterally, with each marking of the type, while the button serves to bring the carriage and paper back to admit the forward feeding of the latter for the next line The types are arranged in a circular basket so as to strike a common centre, and are connected by curved type-rods and levers with keys disposed in a manner similar to the arrangement in the ordinary typewriter of to-day. The movable carriage and paper-feeding mechanism are arranged at the upper or top part of the

framework, while in front of the same the keys are disposed in the usual step-shaped manner. The keys, arranged according to frequency and convenience of use, are connected by downward descending wire rods with a corresponding number of parallel levers that are fulcrumed to cross pivots of the frame and extended backward, carrying at their rear ends the type-rods, which are curved in an upward and inward direction toward a common centre, being guided by suitable guide-plates. As the type-operating levers are arranged to pass below a vibrating pawl-operating bar, the depression of each key produces the action of the double pawl. The spaces between the words are formed by the depression of a space bar. The paper is fed forward for the space required between the lines by means of two feed rollers, of which one is placed above the other, journaled to suitable supports of the carriage, and which act automatically with the same. The shaft of the lower roller is provided with a ratchet wheel and check pawl to prevent backward motion. The shaft of the lower roller is provided with a spur wheel whose radially extending and equidistant teeth are engaged by the free end of a band-spring that is affixed at one end to the frame of the machine, and so twisted or shaped that it presses against one of the spokes when the carriage is drawn back, turning thereby the spur wheel and the feed rollers to the distance required between the lines. This spring may be further arranged to strike a bell when releasing the adjoining spur of the wheel, in order to indicate the approaching end of the travel of the carriage. The carriage is also provided with an indicating pointer running along a graduated scale at the front part of the casing, to enable the operator to see at any time the distance to which the line is printed and when it is completed.

American. The U.S. name of the Armstrong.

Automatic. This was a type-bar machine of the first constructive group. There were forty-eight keys, for capitals, figures, etc.; the dimensions of the machine were $11\frac{1}{2}$ by $8\frac{1}{4}$ by 4 inches, its weight being about ten lbs. It possessed one or two very curious features, one of them being that the space bar was behind the keys, this being enough to kill the machine of itself. The types struck upwards from the centre of the machine, each type travelling only about one inch from the point of rest to the printing point. No ribbon was used, the type receiving their ink from a pad of felt against which they were held by pressure of a spring. The pad could be changed very quickly.

No lower case letters were used, and the machine, which was to sell at $65, died in 1891, after $60,000 had been lost in the venture.

Barrett. This machine was announced in 1904, but does not appear (so far as our enquiries permit us to say) to have been actually placed on the market.

Bennington. This machine has been the subject of several announcements, but for reasons which have, apparently, been sufficient to its sponsors, it has not yet found its way to the market. It is a visible writer, strongly

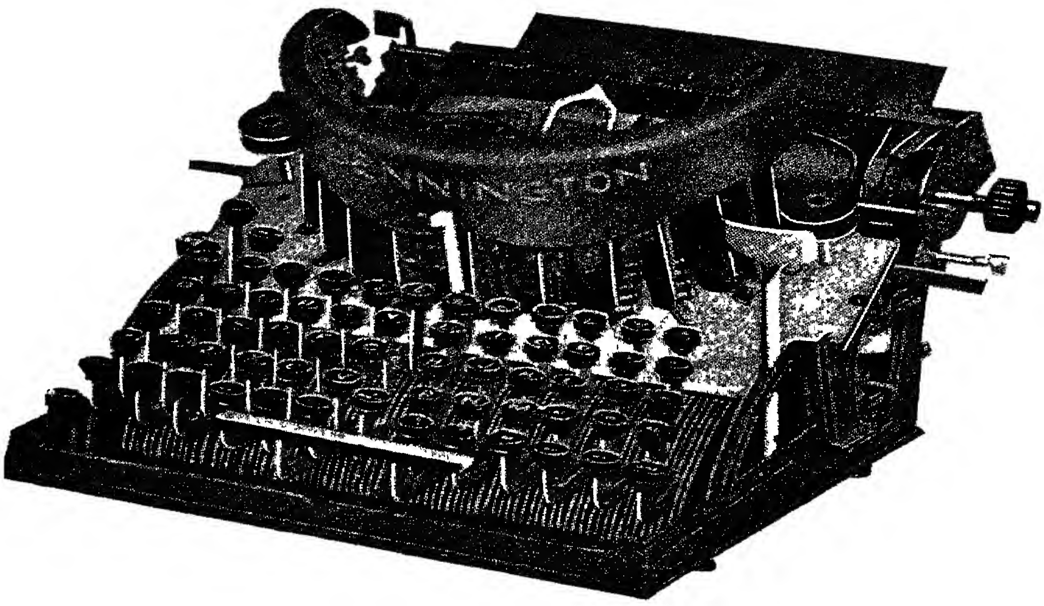


FIG 189

resembling the Bar-Lock in appearance, and its special feature seems to be, if we are correctly informed, the power to strike short words and other frequent combinations, at one blow. We cannot agree that this is a good thing, for this reason: One may very well learn to depress a special key for such a word as "the," but unless a corresponding upper case logotype is provided for "The," the mental hesitation arising will be more than to cover any advantage which might accrue from the use of a single type for "the." It would obviously not be possible to provide duplicate forms of every word provided with logotypes, as by so doing, the keyboard would be swelled to absolutely

unworkable proportions. Compactness of keyboard is a positive essential if typewriting is to be executed at the highest speeds

Bonita Ball Bearing. The same machine as the Sholes-Visible (*q.v.*)

Boston. Another name for the World typewriter.

The Burns Typewriter. An American made type-bar machine, using a ribbon. In response to our request for further details, the makers say:—"We have never had any catalogues or descriptions of the machine published and at present could not furnish you with the information that you ask for, and can only say that this letter is written on a machine that has been in constant service for eight years without any repairs, and must leave you to judge whether the machine does good work or not." As the letter shows a perfect alignment and a good firm impression, this unparalleled modesty on the part of the Burns Typewriter Co. seems much to be regretted.

Carmona, M. S., of Mexico City, Mexico, took out in 1900 two patents on typewriting machines employing but five keys and two key-levers. The machine of these patents is adapted to print ninety-three characters, having its type-faces mounted on a type-wheel, and the operation of different keys causing the type-wheel to rotate a pre-determined number of spaces before making its impression. Consequently, the printing operation is effected by simultaneously depressing some, any or all of the keys to make a single impression, and perhaps manipulating one or other of the key-levers as well.

Cash's Typograph. This machine was placed on the American market about the year 1890, but it did not have any very prolonged career. We are informed that it resembled the Bar-Lock in many respects, since the keys were arranged in the segment of a circle, and stood erect, striking down to the central printing point. The ribbon was carried on two spools, and as these spools were outside the type segment, a very great area was exposed at a time. The machine worked with a single shift-key.

According to the English specification No. 14,860 of 1st November, 1887, means were provided whereby the platen could be perfectly flat, being in fact a frame having stretched across it a sheet of leather, and the framework moved in the same way as the ordinary carriage travels, and then upward between lines. It was, therefore, a flat platen machine, and to this extent anticipated the theory of the modern book typewriters.

Century. An American Company called the Century Machine Co., of New York, endeavoured to promote a typewriter in which no less than nine characters were mounted on each type-bar, the intention being, by the use of suitable shifts and the depression of two or more keys simultaneously, to permit of the writing of syllables and short words at a single stroke. The carriage was at the rear of the machine and the writing—if it could ever be executed—was in full sight

— see also Hess & Stoughton, in this chapter.

— see also Century in Index Machines, Chapter X.

Conde. This machine was launched on the American market in about 1893 As will be seen, the types were mounted at the end of bars standing upright and the platen was raised, so that the bar had a very slight distance to

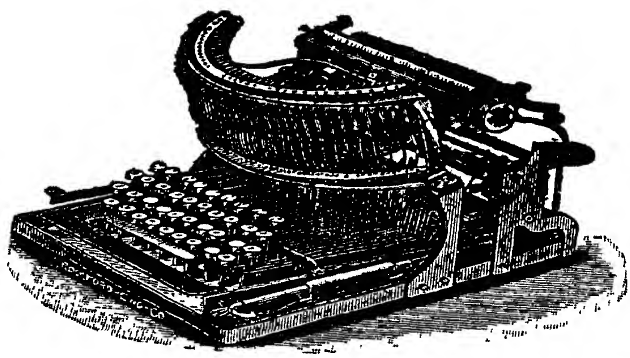


Fig 190

travel in order to meet the paper. It was of very simple construction, there being only about 500 parts, and no ribbon was used, the types deriving the ink from a pad. The whole movement of the carriage was controlled from the keyboard, and the construction of the type-bars was such that alignment was said to have been absolutely and permanently secured

The machine was not a commercial success, and was withdrawn from the market after a very short career. The inventor was said, in 1905, to have been working upon a new machine of the front stroke variety.

Cosmopolitan. Messrs. S Davis & Co , the sewing machine people, introduced the German Kosmopolit into England under this name ; and Messrs. Faudel Phillips and

Sons, of Newgate Street, London, also offered the Crandall under the same style. If our memory serves us rightly, they suggested that drapers and others should run it as a "side line!"

A Chinese Typewriter. An American missionary in China, Rev. D. Z. Sheffield, president of the Tung-Cho College, has invented a remarkable typewriter, capable of printing the 4,000 characters the Chinaman finds absolutely necessary for transacting his ordinary business affairs. *The Scientific American*, from which our illustration is reproduced, gives the following description of the machine. The 4,000 characters are grouped in alphabetical order according to their accepted spelling in English, a large number of those most commonly used being placed in a

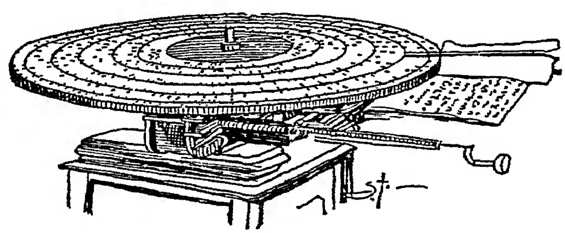


FIG 191

separate group regardless of spelling. The type are cast on the under part of the large wheel, the upper side of which is covered with printed characters, each one exactly over the type it represents. The carriage moves freely to the right or left, and projecting from it there is a pointer which is used to locate the characters to be printed. In operation the wheel is revolved with the left hand until the group or line in which the desired character to be found is opposite the carriage, and the carriage is then moved with the right hand to the right or left until the pointer covers the character sought for. To the right will be seen a little crank, one turn of which inks the type, while a small hammer forces the paper against the type, leaving a clear impression. The type-wheel locks during the printing and is automatically corrected if slightly out of place, the characters being brought into perfect alignment. The mechanism performs the operation of spacing, etc., as in other machines.

At first thought it would seem even with this machine, that the writing of Chinese would be slow and tedious, but when it is considered that the written character consists of

from two to twenty-five strokes, which even the best Chinese scholars write slowly, as they handle the brush delicately, and that a character signifies not a letter but a whole word, it will be readily seen that Dr. Sheffield's machine saves a great amount of both time and labour.

Circular Keyboard Machines. On reference to the illustration of Progin's machine it will be seen that types are arranged in a circle, and strike downward to the paper. The circular arrangement has tempted many inventors, prominent among whom are those hereafter described. By affixing the type at the lower end of a piston rod, and the key at the upper end, a very rapid movement may be secured, but this speed is quite lost owing to the area over which the fingers have to travel from key to key.

Machines of this form include the following, which are to be found on the pages stated: Daw & Tate, p. 265; Donnelly, p. 265; Lambert, p. 278.

Crary. This machine appeared about 1894 in New York. It was the invention of Mr. J. M. Crary, and we learn from a paragraph in the *New York Sun* that:—"It bears but slight resemblance to any of the standard typewriters in use, weighing but ten pounds, and being built on simple and compact lines. The keyboard is disc-shaped and contains eighty celluloid keys. The ribbon can be changed with great celerity. The machine will receive a book of any required size or thickness. It has perfectly flat platens, separate from the feed rollers, and when several copies of manuscript are required, a platen made of brass is used. A single sheet of notepaper seems quite as much at home between its rollers as a double-entry ledger. And to crown it, the price of the machine, although not yet fixed, is certain to undercut the hundred dollar marks on other first-class typewriters." The Crary is, however, no longer made.

Cox, Chas. This gentleman, a resident in Brooklyn, "has perfected a fifty dollar visible that should prove a seller, if manufactured properly."

Dart Marking Machine. This machine is a typewriter for the purpose of preparing window-tickets, bulletins, etc., or for writing on wooden surfaces, such as the lids of packing cases, and so on. The English agents are the Gem Supplies Co., Limited, of Peartree St., London, E.C. The device consists of an index like the hand of a clock, which is revolved over the surface of a dial plate until it points to the letter, figure, or sign required. As it turns, it revolves a type-wheel fixed in an up and down direction, and when

the index points to the desired letter, the corresponding letter is at the lowest point of the wheel. Pressure being applied, causes the supporting mechanism to sink, until the rubber faced type on the edge of the wheel meets the object to be printed upon. Inking is effected by means of a pair of small ink rollers which bear constantly on the surface of the type and keep the same well inked The spacing between letters is performed automatically.

Donnelley. This machine possessed some very remarkable and distinctive features. As will be seen by the illustration, it consists of a base supporting a travelling carriage, over which is a drum, the top of which represents the keyboard, the type lever being contained inside.

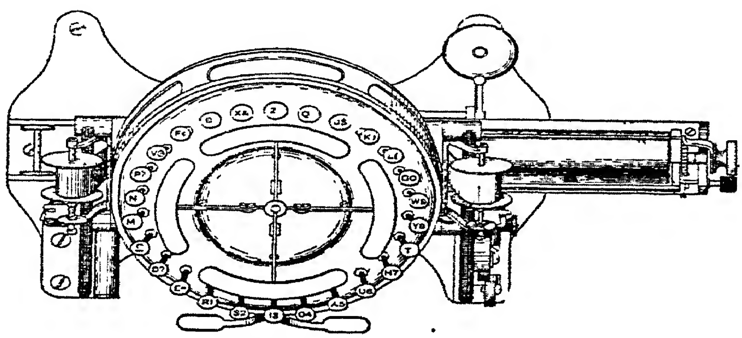


Fig. 192

There were twenty-six keys, working with two shifts, and the type levers ended in a small cog wheel, so that when a shift-key was depressed, the type-bars rotated to right or left as might be in order to effect the change of case. The machine was not, from all we can learn, made commercially, but it presented a very great possibility in typewriter construction which may, some day or other, be seized upon and very much elaborated.

Dollar Typewriter. This machine appears to be identical with that at one time sold in England as the Simplex (*q. v*) or in America as the Herrington (*q. v.*)

Daw & Tate Typewriter. These curious machines, which date from about 1885, are relics of the early days of English typewriters, and although they cannot for a moment be considered as practical instruments, are yet worthy of being rescued from oblivion.

Two models of the machine were made. One was a

light portable instrument, intended really as a mechanical shorthand machine, using ordinary characters under a code of contraction. It weighed about five pounds, and was circular in shape, the keys being arranged, piston shape, round the edge of the top of the machine. The depression of the key, which was very short and light, sent the type-bar downward through an opening, fore-runner

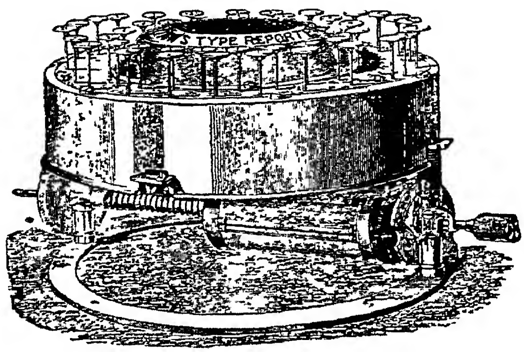


Fig 193

of the modern Yost guide. Only capitals and figures were used on this machine, but as appears to have been the fetish of English-made typewriters, the machine possessed the feature of differential spacing, which has already been referred to in connection with the Maskelyne and Waverley typewriters. The paper was carried under grippers on a hollow cylinder at the base of the machine, and this was made to revolve between letters on an Archimedian screw (the first example of this movement ever attempted in typewriters), and from left to right between lines. This movement may be compared with that of the Hanson-Lee machine referred to in this chapter. The method of inking was strange, since no pad or ribbon was used, but in lieu thereof, a strip of carbon paper was laid over the paper to be written on, and as the type struck the back of this strip, it left an imprint underneath.

The other machine was a business or commercial one, which contained various founts of type. A simple hand dial adjusted the type to the fount, and every type piece produced a movement of the paper corresponding to its own width. Any width of paper up to brief could be used, and the writing was visible. The letter was inked by a pad on the first movement of the piston, and struck the paper direct. Every variety of ruling, from straight lines

to circles, was said to be possible, and tabular work capable of ready execution.

Our illustration is of the smaller or shorthand machine and the larger machine took very much the same shape.

Dactyle. The name, in France, of the Blickensderfer.

Defi. An alternative name for the Eagle Typewriter (which see).

Draper. Sears, Roebuck & Co., of Chicago, "having made a contract with the manufacturer" of the machine known in this country as the Chicago, "by which they agreed to take the largest number of machines ever contracted for by any concern in the world," advertised it in 1906 under the above title at the price of $18.73, say £3 18s. English money.

Duke Typewriter.—This machine is at present unmarketed, although we understand efforts are being, or have been, made to influence capital in this country It is the property of the Duke Typewriter Co., of Little Rock, Arkansas, and possesses some extremely curious and highly developed features. It consists of practically

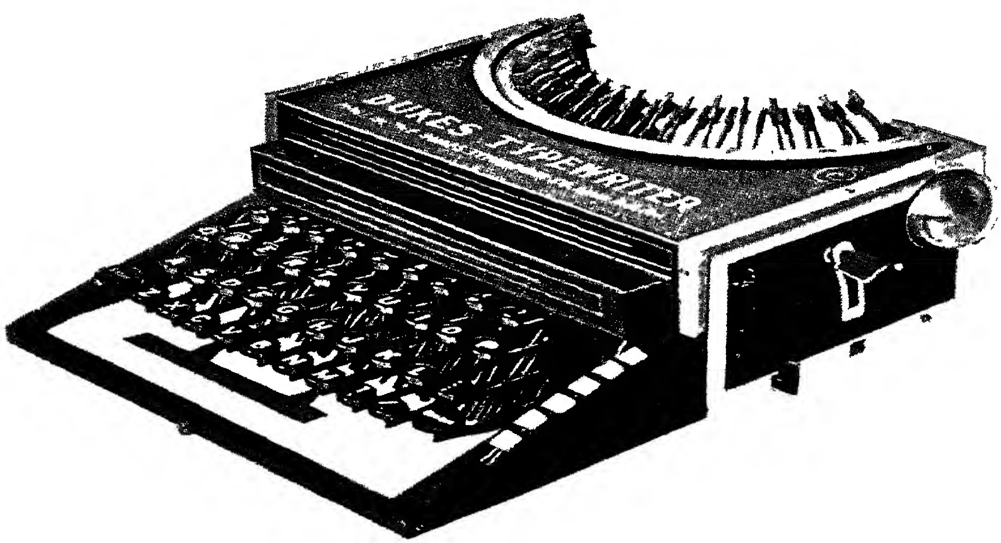


FIG 194.

three parts, one being the keyboard and type-bar mechanism, another being a table with suitable rails and guides thereon, so that when the operative part is used, it travels

along the guide rails, and so permits of writing in books, and so on. The third part is a stationary base, with a movable platen, and when the writing mechanism is attached to this, the platen travels It is, therefore, a book-typewriter as well as an ordinary commercial instrument. The mechanism appears, from the descriptions we have seen, to be very complex, but undoubtedly, were such an instrument ever brought to such perfection and popularity as might be, then it would represent almost the last word in typewriter advance. The keyboard part is worked with a single shift, inked by a ribbon, and the type-bars stand erect, and strike down away from the operator, as in the case of the Bar-Lock

Eagle Typewriter. A very neat and entirely workable little machine, working by means of a double shift, and inked by a ribbon. The types were arranged on

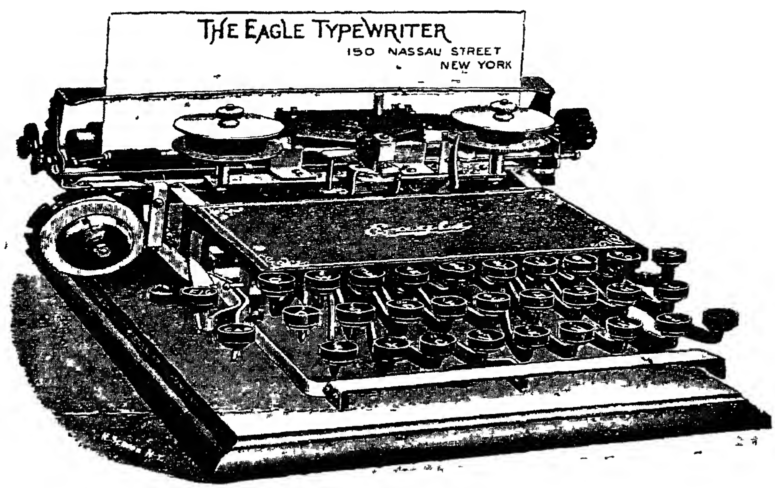


Fig 195

the periphery of a segment of a truss-wheel, very similar to that of the Keystone. The property in the machine passed to an American company, a representative of which was in London in the early part of the 1900's, endeavouring to interest the English market.

The Eclipse. This machine had an unfortunate name and career, since it has itself been totally eclipsed. It used a ribbon, and the types were mounted at the end of bars striking down towards the operator. There were

two shift-keys, and the general appearance of the Eclipse was such that even an expert might, at first glance, mistake it for a Brooks ; if indeed, the Eclipse be not the Brooks under another name.

Edison-Mimeograph. This machine was placed upon the market by the A. B Dick Co., who stated that their object in so doing was to provide a machine at a low price and which could be relied upon at all times to cut a good stencil for use with their duplicating apparatus. The front part of the machine was arranged as an index plate, and on top of the machine was a hinged carriage which travelled and lifted in the usual way. The types themselves were separate pieces, as in the Merritt, and were set in a circular frame so that when the index-pointer was turned it brought the corresponding letter under the printing point. The printing key was then depressed and a small hammer struck upwards and drove the type home The machine did not find its usefulness entirely confined to stencil cutting, but would also turn out very good work as an ordinary machine, although, of course, not at a very high speed. The machine had not been on the market long before it was withdrawn by the promoters who did not wish to compete with the makers of other machines who used their duplicating apparatus.

Essex A low-priced type-wheel machine which existed but a very short time. The keyboard was of the universal order, and worked by means of two shift-keys. The type was arranged on the periphery of a segment of a

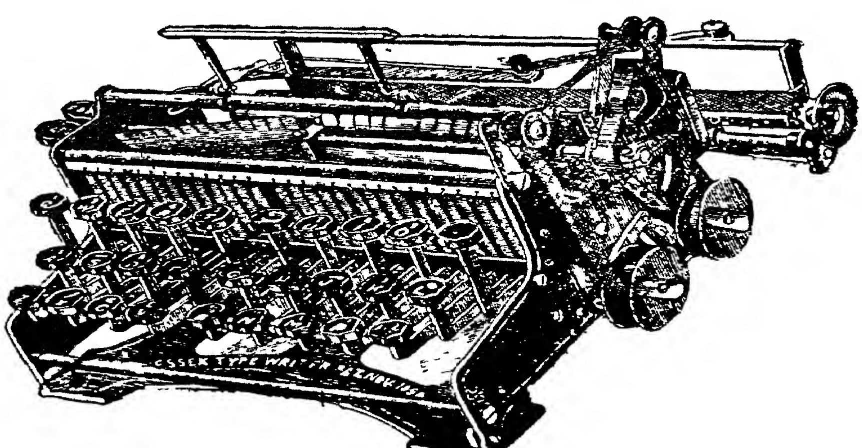


FIG. 196

circle, which was mounted at the right hand of a revolving bar, the revolutions of which were governed by the depression of the keys, and the extent of movement differing, of course, according to the particular key struck The ribbon was carried on two spools, fixed to the outer right side of the framework, and practically described a movement of three sides of a square, in its travel. If our information is right, when the selected letter was brought opposite the printing point, the act of printing was effected by the carriage carrying the paper, being thrown forward towards the type-wheel.

Excelsior. This machine was manufactured by a company called the Excelsior Script and Type Writing Machine Co , the head offices at which were at San Francisco. It did not, however, have a very prolonged career, but soon passed away The great feature which it presented was that it was capable of executing work in both ordinary type as well as in *fac simile* longhand characters. The makers offered to produce, in connection with the machine, a fount of type the exact counterpart of the purchaser's own hand-writing, the connections between the various letters being so perfectly made, as not to show where one ended and the next commenced. Possibly the lack of success which it met with was on account of this feature, for very few hand-writings are worthy of this honour !

Favorite. The German title given to the Armstrong.

Fisher, L. G. This gentleman, for many years with the Oliver Typewriter Co., was stated in 1904 to have perfected a machine which followed closely on the Oliver lines, but instead of using a double shift, adopted the Remington keyboard of four key-banks and a capital shift-key only. Although a Philadelphia capitalist secured an option thereon, and undertook to get the machine before the public at an early date, we have not heard that this promise was carried out.

Fountain. This machine was of a type-wheel, ribbon-writing variety, using twenty-eight keys and two shifts. It does not appear to have endured.

Fay-Sholes Typewriter. The following details were quoted by *Office Appliances*, in reporting a judgment of Chief Justice Fuller of the Supreme Court of the United States, and will enable the reader to understand the reasons for the change of name in connection with this machine.

" In 1894, Franklin Remington, a son of Samuel Remington, together with Zalmon O. Sholes, organised the Remington-Sholes Company Zalmon G. Sholes of this company was a son of C. Latham Sholes, the inventor of the first Remington Typewriter.

" Upon the advice of its attorneys the Remington-Sholes Company was instructed to proceed with the use of that name, the attorneys advising that so long as they used the name honestly and without intention to deceive or confuse, they had a perfect right to use the name.

" In 1898, four years after the organization of the Remington-Sholes Company, the manufacturers of the Remington Standard sued the Remington-Sholes Company with a view to making them abandon the use of the name Remington in combination with their typewriter. In 1901 Judge Wheeler, of Vermont, rendered a decision implying that the Remington-Sholes Company had not the right to use the name Remington, or even a trade-mark name "Rem-Sho." under which their machines were sold

" In 1901 the Remington-Sholes Company complied with the court decisions and changed its name to the Fay-Sholes Typewriter Company.

" The decision of Judge Wheeler was appealed from in 1903 to the United States Appellate Court in New York, which partly reversed Judge Wheeler's decision, thereby giving the Fay-Sholes Company the right to use the trade-mark name " Rem-Sho " From this decision an appeal was taken to the United States Supreme Court with the result that the Fay-Sholes Company, originally the Remington-Sholes Company, was sustained in its position in every point."

Glove Typewriter. This curious piece of work can hardly have been intended as a practical writing instrument. It consisted of a pair of gloves made of wash leather, with embossed india-rubber type mounted thereon and distributed at various parts of the fingers, the capitals being worn on the left hand, the lower case on the right. The ink was supplied by a couple of pads, fixed to the palms of the gloves. The act of shutting the hand conveyed the ink to the type, which were embossed in India-rubber. All the operator had then to do was to dab that particular part of the glove required on to the paper, but how regularity or alignment was to be secured, nobody can tell.

Hanson-Lee. This peculiar machine is a distinct and radical departure from all its predecessors in the art

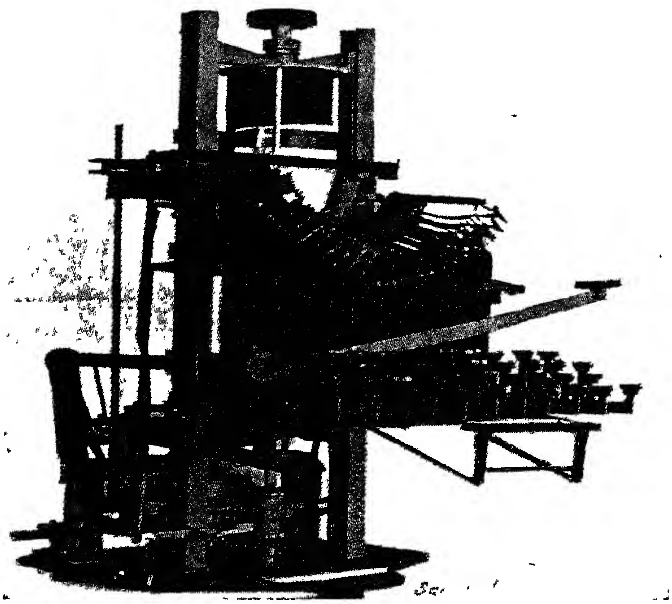


FIG 197.

of mechanical writing, its distinguishing characteristics being a vertically arranged horizontal revolving platen, in connection with a horizontally disposed keyboard. By reason of this device this machine is peculiarly adapted for commercial work, involving long columns of figures, while at the same time it is equally as serviceable for correspondence, and the making of copies, as are the machines in ordinary use, employing horizontally arranged platens.

As shown in the accompanying illustration, the Hanson-Lee machine is provided with a pair of vertical guide-posts, grooved for the reception of a vertically movable platen-supporting slide, the said platen being automatically revolved by the depression of the type-levers, and of a proper diameter to permit the sheet of paper to be wrapped around it, and held by a series of open annular spring bands. Besides the usual type-key, shift, and spacer-bar levers, there is a line key with connecting mechanism, so that the platen can be elevated the space of either a single or a double line, as desired ; and a margin-regulating mechanism and key, so that, at the end of a line (or sooner if desired) by touching this last-named key, the platen will whirl around and stop at the predetermined distance

from the left edge of the sheet, for the beginning of the next line, the adjustment of the margin to any width desired being quickly made, and as quickly changed. The ribbon feeds automatically, and is vertically disposed across the front of the platen, and as it is very narrow, only the line being typewritten is concealed thereby, all the preceding lines being always distinctly visible. The platen-supporting slide is movably supported on a central vertical shaft, and at any time can be depressed by hand thereon, if it is desirable to lower it, but the entire action of the machine is automatic, and by depressing an arm, and thereby forcing the platen-supporting slide from engagement with the dogs which ordinarily raise the platen, tooth by tooth, for each line, the slide carrying the platen will be instantly raised its full height, so as to be in position to remove the sheet of paper therefrom, or place a fresh sheet thereon, after which the platen can be quickly depressed to its initial position.

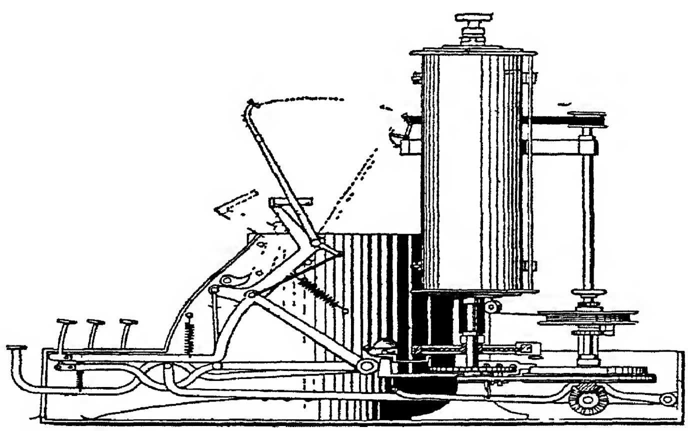


DIAGRAM SHOWING THE ACTION OF THE TYPEWRITER

FIG 198

The actuating mechanism for vertically moving or horizontally revolving the platen comprises independent spring mechanism and suitable connections, there being two drums, with volute springs therein adapted to revolve said drums in opposite directions, the described line-key being connected with one of said drums for automatically raising the platen, without rotating the same, and the margin-regulating key being connected to the other drum for automatically revolving the platen, without varying its elevation, by the mere act of depression of one or the other of the said keys. Further, each time the last-named key is

depressed to revolve the platen the spring within the drum connected thereto is thereby automatically wound up, so that there is no "running down" of the spring from constant use, and no winding by hand necessary.

The characters are arranged, as is usual in shift machines, in pairs at the ends of the type-bars, which latter are supported in radially-disposed grooves in an arc-shaped guide, pivotally secured to the uprights of the machine, said type-bars being linked to the type-key levers, and when the shift-key is struck, the said guide, with the rear ends of the levers connected thereto, is thereby carried to the left, and changed in position so that the "upper case" characters will properly strike the common point of impact without any lateral change of position of the platen, the release of the shift-key causing the said guide to return to its normal position, this being accomplished without any frictional resistance or interference.

The original machine was invented by the late Walter H. Hanson, of Milwaukee, and patented some years ago, since which time it has been greatly improved and simplified, and is protected by a series of patents in the United States, Canada, and the principal European countries.

An English machine, embodying a similar principle, was patented in 1903 by Mr. J. G. Whyte, of Upton Manor, Essex. In this case the cylinder was mounted on an upright post, having a spiral thread cut in its face and being fixed in a wheel socket. The latter revolved between letters, and the screw post revolved between lines, thus providing the usual spaces. The machine has not yet been marketed.

Hess and Stoughton. These gentlemen (residents of New York) took out two patents in 1900 for a typewriter. In the machine covered in the patents, each type-bar is equipped with a sleeve having three type-carrying faces. In the patents, three types are shown on each face of the bar or sleeve, and three keys are employed in connection with each type-lever, so that whenever a key is depressed, the corresponding character on the face of the rotatable sleeve will be brought opposite the platen and to the printing point. This is effected in such manner that when the sleeve shifting or rotating key is depressed, it becomes locked, avoiding the necessity of keeping the finger on the "shift" key.

This patent was assigned to the Century Machine Co., of New York (*see Century*). See also *Donnelly* for earlier example of revolving type-bar.

The Horton. This machine, like the Empire, to which reference has already been made, was of Canadian origin, having been manufactured by the Horton Typewriter Co., of Toronto, and its resemblance to the Barlock will be apparent on a view of the illustration herewith. It will be seen that the carriage is placed at the rear, but that it does not rest on the bed of the machine. On the contrary, it is raised, and to accommodate it in its elevated position, the type-bars, which intervene between the

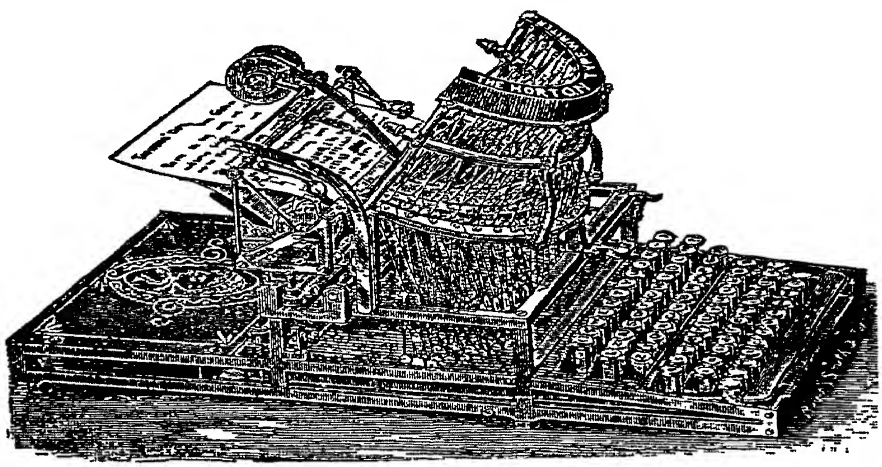


Fig 199

keyboard and the carriage, are made to lean backward toward the operator. We have seen in the chapter on the Front-strike machines, how this tendency towards reclination has been developed slowly and by degrees until, finally, the type-bars have lain flat on their backs, and the carriage elevated until its altitude was equivalent to the length of the type-bar itself

In addition, the Horton type-bars were not arranged in a single curve, but in three, one being placed behind the other. This had the effect of reducing the length of the bar, and so conducing to celerity of action.

One of the weaknesses of the machine was its limited keyboard, only seventy-three keys being provided. The space-bar extended the whole width of the machine. The ribbon, which was quite automatic in its action, was carried on two spools, but as will be seen, the position in which these were placed caused a considerable length of ribbon

to be exposed, which interfered with the free visibility of the writing. The Horton did not have a very extended career, and is now very seldom heard of

Hyndman's National An ambitious title given to a very low-priced index machine, which has long since ceased to exist.

Imperial Typewriter The machine, of American invention, was submitted to the public early in the '90's. It was of the same class of machines as the Smith Premier,

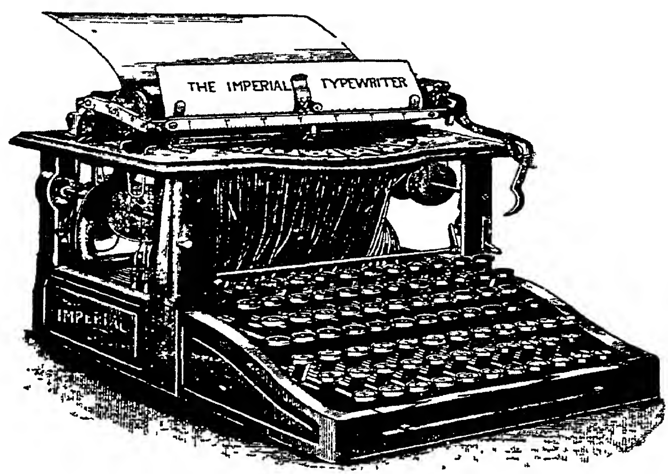


FIG 200

inasmuch as it had a full keyboard, was inked with a ribbon, and the carriage was placed on top of the machine. It does not appear to have had a prolonged career

Index Visible. We have had this machine described to us in the following terms: "The types are engraved on a wheel, similar to that of the Blick. The wheel is mounted on a hollow post, containing a spring. On the outside of the post is a cord, which, when pulled out, causes the post to revolve to a greater or lesser extent, and in revolving, the post, of course, carries the wheel with it, so that by pulling the end of the cord into such a position that it reaches any letter on the index-plate the corresponding type faces the printing point The paper is carried in a platen, which is hinged, and can then be thrown forward into contact with the ink ribbon by depression of a printing key." This machine is probably the second instrument produced by the makers of the Commercial Visible typewriter, and referred to in our account of that machine.

The Jackson. This machine was made at Bridport, Conn , U.S.A., by a Company registered in 1905, with a capital of half a million dollars, but it was never actually put on the market.

As will be seen on reference to the illustration, and comparing it with that of the Victorian Model Maskelyne, there is a great resemblance between the two machines, although the Jackson was not a differential spacer The type-bar movement was very similar to that of the Williams

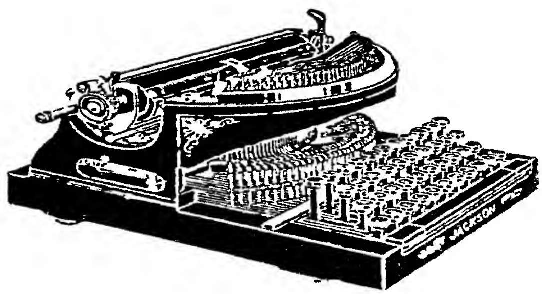


FIG 201

It was the type-bar, ink-pad, and visible writing variety, worked with a single shift-key and thirty-eight keys (affecting seventy-six characters or letters).

The promoters made much of the fact that it was a real sight writer, that is to say when once a piece of work was executed, every character remained clearly visible, and was not curled up into a paper receiver or passed away under towers of keys.

Naturally, a great claim was made on account of the supposed increased power of blow arising from direct printing, and the reduction in the number of parts was urged as proof of its simplicity and strength.

Johnson Book Typewriter. A Company under the foregoing title was registered in 1896, for the purpose of manufacturing and selling an improved machine to write in books and records. Its capital was $100,000, in shares of $100, all of which was taken up, but if the machine was ever marketed, of which we have no evidence, then it has long since passed into the *ewigkeit*.

The Kent Typewriter. The illustration is engraved from a circular issued in 1892 by the Kent Writing Machine Company, by which they were then endeavouring to sell "an additional issue of three thousand shares of its capital stock at $1 per share," by which it was hoped to raise

money " for the purpose of completing the improved model now in course of construction." As that is now many years ago, and the machine has not (as far as our knowledge goes) yet appeared, it is safe to assume that it " is not yet on the market." The Kent typewriter is supposed to be

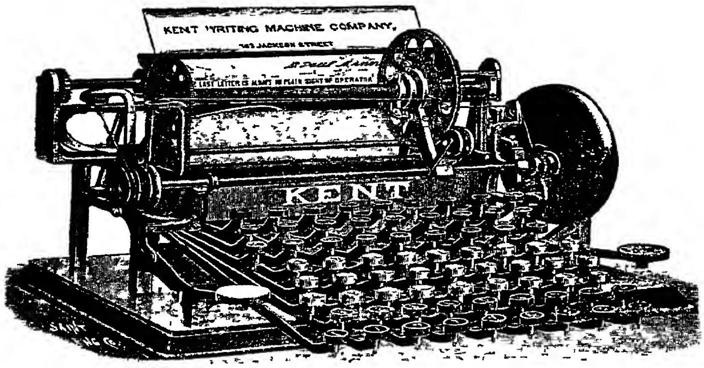


FIG 202

operated by electricity, the operator merely " touches the button " (whatever that may be), " and electricity does the rest." It is, in a manner, a type-wheel machine, the types being arranged around the large wheel on top of the machine. In their prospectus the Company says: " The time will surely come when this machine will be used on every railroad and telegraph line in the world."

The machine, it will be noticed, presents one or two singular features, not the least curious of which is, that the types are engraved on the edge of the large wheel, which revolves between the letters, and travels from left to right as the line is gradually filled up. No information is afforded as to how the wheel is to be returned at the end of the line. The Kent, from a casual glance, might almost be taken for a patent knife cleaner, or some other article of household use, and the name of Kent, so well known to Londoners, will aid in the delusion.

Kidder, Wellington P. Inventor of the Franklin and Empire (or Wellington) machines, which see.

The Lambert. The Lambert typewriter is an American invention which took seventeen years to perfect. It prints all the letters, figures, points and symbols, by moving one part with comparative slowness. The parts are all interchangeable. In the Lambert it is possible to change from one sign or type to another, from one

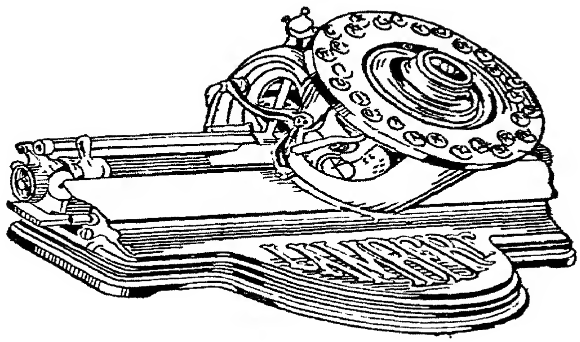


FIG 203.

set of symbols and points to another, or from one language to another, by changing three parts in a few minutes. It prints from the type direct; not through a ribbon. Its print is clear, and this is always so because the type never gets fouled.

The type is inked by a pad, which is easily inked when dry, and replaced when worn out. The ink-pad of the Lambert costs one-fourth as much as a ribbon, and lasts half as long. The other after expense is about in the same proportion.

The chief novelty of the Lambert lies in the fact that the "keyboard" is no keyboard at all, but a mere plate. It hangs on a ball-and-socket joint at its centre. Touch a letter; it tilts and prints. The type-plate is under the foot, a finger's length below; it is all one piece. When the plate is tilted, the foot swings away from the letter touched, and brings that very type to the centre, where the printing is done—through the square hole in the shield of the ink-pad.

The Lambert is sold in a neat little leather case about the size of a small brief bag, and weighs in all under nine pounds. It can be conveniently carried about when travelling. That it is fast may be inferred from the fact that several typists are said to have averaged 110 words a minute.

The Lasar. This machine has also been described as a very large and heavy one. It bore considerable resemblance to the Horton. Only a few experimental machines were made. We have no details of the Lasar, but our information is that it infringed on some other patents, and it was largely owing to an appeal—threatened, if not actually made—to the Courts, that the manufacture of the machine was not persisted in.

The inventor was recently stated to have been working on another machine, the model of which was likely to be ready for inspection at an early date.

Mackness. This machine was announced in 1895, and was to be issued from Dundee It is described as a shift-key machine, and the announcement states that it embodies several important points which are not embodied in any other machine so far on the market. The inventor is Mr. C. F. Mackness, son of Dr. Mackness, of Broughty Ferry. It does not appear, however, that the Mackness ever took actual shape.

Matrix Forming Machines. A number of patents have been secured covering methods whereby the impression made by the type can be converted into a matrix from which a stereotype block for printing can be formed. It is clear that if a thin sheet of pliable metal, say pewter, backed by blotting paper, be fed into the machine, and the ribbon removed, the sharp face of the type will form indentations corresponding to the keys struck. This indented sheet of metal may then be treated in either of two ways. First, the indentations may be filled up by means of very fine plaster of Paris so as to make them firm enough to withstand pressure during the act of printing, and the sheet then mounted type high and used with other type or blocks in the forme ; or, secondly, a proper stereotype might be made from the metal in the usual way

The former of these processes is the basis of a series of patents by Messrs. Hetherton & Cordeaux, and is developed in the form of a duplicating apparatus The work turned out by this process is exceedingly clear and sharp, but the printing operation is very slow and it has not been found practicable, owing to inking difficulties, to do good work of a larger size than octavo.

In other patents, machines have been made to perforate the paper used as stencil into a series of dotted holes, and photography has then been called in to assist in converting a sensitized metal plate into a stereo by the action of light passing through the openings.

Electricity has been requisitioned to increase the force of the blow and either new machines devised for the purpose, or as (according to *La Plume Stenographique*) was the case with an invention by M. Jules Buse, an ordinary type-writer has been converted. M. Buse used a Williams. He attached one of the poles of the battery to the keyboard, the other to the platen. Typing on to a sheet of flexible

metal, it followed that when a key was struck and the type was at the printing point the circuit was complete, and the blow considerably increased in force, so that the matrix, after electrotyping, readily yielded a good stereotype block.

Megagraph. This machine, the invention of Mr. McCann, was a giant, and claimed to be the largest machine made. It was 6 ft. in height, 5 ft. 10 in. long, and 3 ft 4 in in width. The weight was 400 lbs., and the size of the characters was proportionate to the machine itself. A full fount was used, capitals, lower case, signs and figures. The inking was effected by means of an ink roll, and by a special construction the space each character occupied was according to its width : in other words, it had differential spacing. Its object was to print newspaper bulletins, market price-lists, &c , but evidently the demand did not justify its continued manufacture

Myers, James H., took out a patent in 1900 for a very interesting book typewriter, " a peculiar characteristic of which is that it can be manipulated to shift the carriage either from right to left or left to right in the process of writing a line. This is effected by causing the pawl of the escapement mechanism to normally engage the one side or the other of the pinion according as it may be desired to operate the machine."

The machine does not seem to have been placed on the market

Official Typewriter. This machine was a very dainty little machine of the type-wheel class, and was placed upon the market—or intended so to be—some time about 1900. For simplicity of construction, it was claimed that the " Official " was without a peer. The total number of parts used in its construction was only 170, which is a reduction to a minimum.

As will be seen, there are twenty-eight keys, working with a double shift. The type-wheel revolves by the depression of the required key, and simultaneously therewith a hammer from the rear portion taps the paper, sending it, with the ribbon intervening, up to the type

Moreover, the force of the blow could be increased, within moderation, *ad lib* , so that the Official was a good manifolder. It was intended to place the machine on the market to sell at $20 (say four pounds) but whether it ever reached that stage or not, we are unable to say (see illustration on next page).

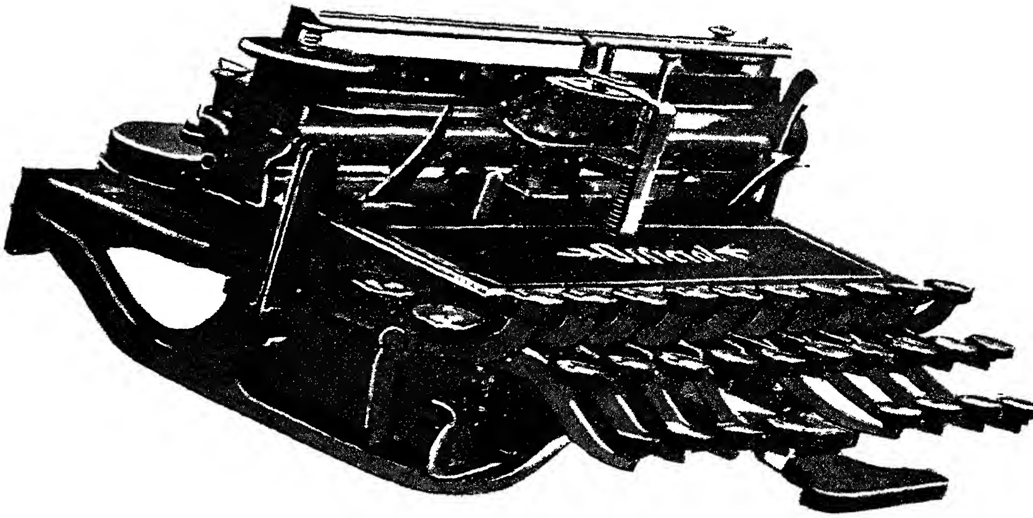


FIG 204.

Parisienne. An index machine, made in France, about 1885, by M. Enjalbert. It was a workable machine, but very awkward in construction and slow in operation. It is no longer made.

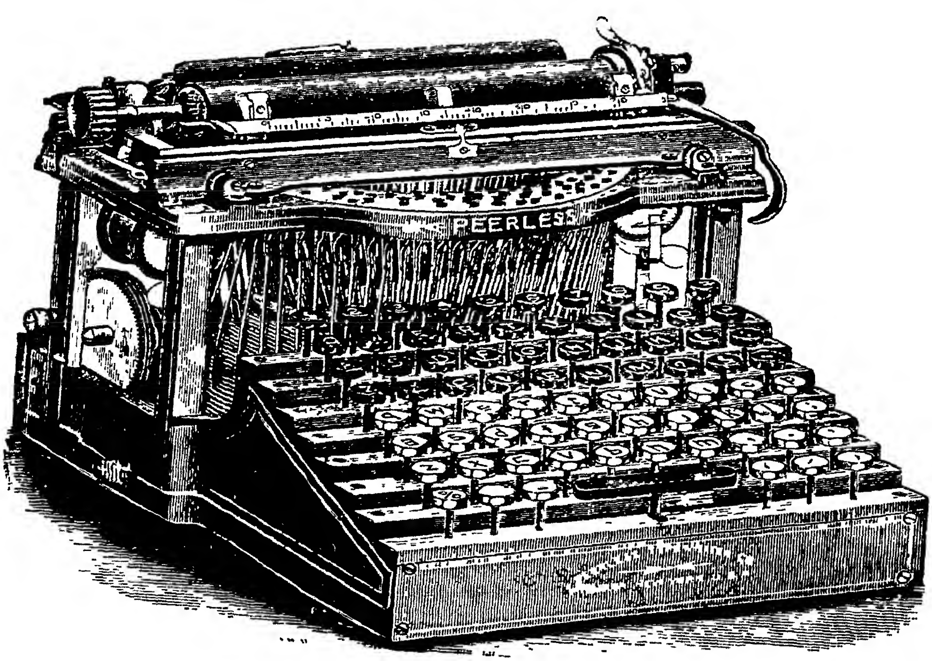


FIG 205

The Peerless. This machine was designed (the prospectus used the word "invented") by a brother of the Mr. L. C. Smith whose name was so long associated with the Smith-Premier, and the family relationship between that instrument and the one now under notice will be immediately observed on a comparison of the illustrations. The Peerless, however, did not use the rocking shaft, but brought the types to the paper by means of the almost universally employed lever. An attempt to float the machine in this country was unsuccessful.

The machine is not now being made.

Rapide. The name, in France, of the Salter typewriter.

The Shimer. Very elaborate preparations were made to establish this machine, but at the last moment it was withdrawn, for reasons which the makers did not consider themselves at liberty to make known. By the courtesy of the Oliver Typewriter Co. of Chicago, we are, however,

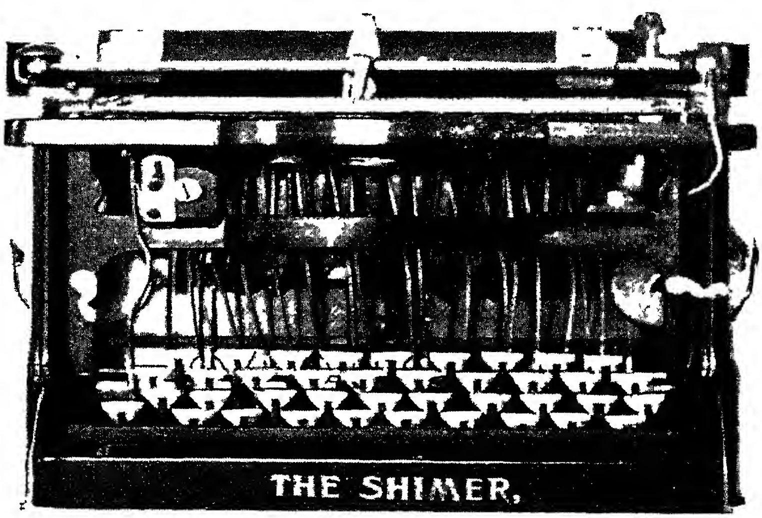


FIG 206

enabled to submit an illustration of the machine, from which it will be seen that the Shimer bore considerable resemblance to the Remington, there being four rows of keys, and a single shift-key. The types were mounted on bars, which struck upward to the printing point. The inking arrangements were a ribbon, mounted on two spools, the latter having reversing handles on the front posts of the framework.

The Sholes-Visible. This typewriter was invented by Mr. C. Latham Sholes, who took a prominent part in the early history of the typewriter. It writes in sight and shows not only the line that is being written in view of the operator, but also all that has already been written. This is a very important feature. The makers recommended it for the following reasons :—

Simple Construction The Visible Sholes has been so simplified that it is much less subject to derangement than is the complicated mechanism of other machines, and the cost of manufacture has been reduced to an extent which admits of a very considerable reduction in price. It has fewer parts than any other standard typewriter, and the mechanism throughout is so simple that the noise and possibility of derangement are reduced to a minimum. Necessary repairs can in most cases be made by the operator.

Platen The platen of the Visible Sholes is fitted with knobs and all necessary attachments for single or double line spacing It provides independent movement of the roll for writing on ruled paper or for billing. Movable paper fingers are also provided. Those can be adjusted for any width of paper, card, or envelope. The machine also has automatic ribbon feed, double and single spacers, scale, etc., etc.

Type-Bars. The type-bar is made of one piece, L-shaped, and operates in a guide the entire distance from the moment the key is pressed until the type strikes the paper. There are no joints in the type-bar ; it is impossible for the machine to get out of alignment ; the type is forged on the type-bar. thus insuring uniformity and durability. This is a feature of no other machine.

Keyboard. The keyboard of the Visible Sholes is the universal standard with one shift. The speed of the machine is limited only to the ability of the operator. The direct stroke of the type-bar renders the Visible Sholes a particularly powerful manifolder.

Important Points. In appearance the Visible Sholes is handsome The nickelled and enamelled parts are given a very fine finish. These features are important :—Absolutely visible writing, simple and durable in construction, type forged on bars, powerful manifolder, very light and rapid key action, makes but little noise.

Secretary. The little machine known as the Eagle was controlled by an American corporation of this name, and the instrument was sometimes referred to by such title.

The Silent. This machine probably did little more than reach the invention stage, and although a machine which justifies the use of the title has long been waited for, yet the world still waits. The claim was made on behalf of the Silent, that it was the only machine capable of doing its work noiselessly. This feature was not accompanied by any counterbalancing defect, for it was said to be rapid as any other and just as good for manifolding The method by which the machine worked, and which secured its noiselessness was very simple. The type-bar was in the shape of an elbow, and when the key was struck, the type found its way almost to the surface of the paper, and was then pressed, by means of a toggle joint, into actual contact therewith. Whilst this movement may have readily secured a good impression, even through a ribbon, it is a little difficult to imagine that the double movement, the second (*i.e.*, sending the type home) of which would only commence at the termination of the first (*i e* , bringing it into position) could have been executed with that celerity which is now looked for, whilst the amount of dead pressure required to produce say three or four carbon copies, must have been, had the machine been put to practical use, very great.

Slocum Visible. We have found references to a machine of this name ; but cannot learn any details as to its construction.

Tangible. The Tangible Typewriter Company was registered in 1895 with a capital of £5,000 in £1 shares. The object of the Tangible was to provide a means of executing embossed writing, for the use of the blind. The machine was extremely simple, and capable of being learned and manipulated with ease, but the venture did not prove to be a commercial success.

Triple Typewriter, A. *The Typewriter Trade Journal* (of New York) presents the accompanying illustration of a triple typewriter, manufactured by a Cincinatti firm out of three Smith-Premier machines. The front portion, it will be observed, is a machine complete in itself, but at the rear are two other machines, divested of their keyboards, and so connected with the front machine that on the depression of any one key, all three type-bars move simultaneously towards the printing point. The three carriages also travel together, so that three separate top copies of any piece of work can be typed at one operation.

The machine illustrated was required for use by a manufacturing business, where duplicate orders were

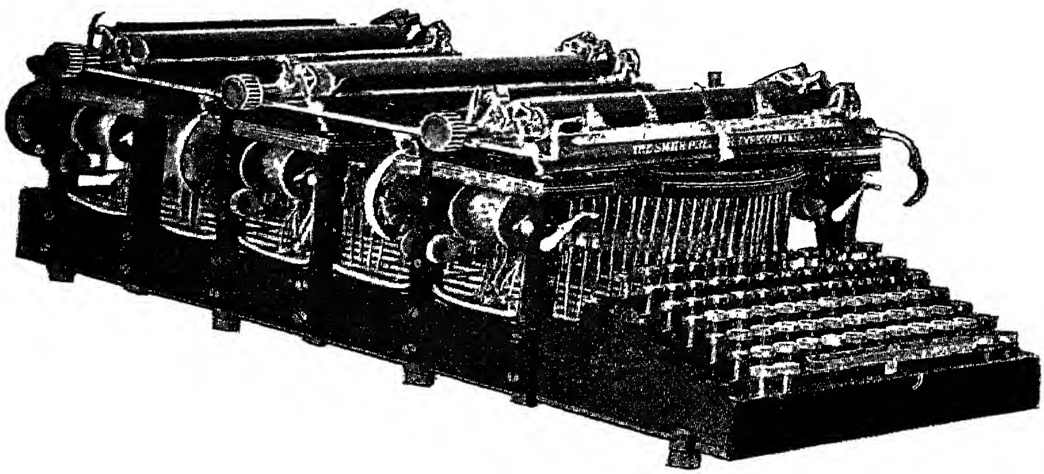


FIG 207

required. These orders involved much handling during the manufacture of the goods, and cardboard was found to be the only suitable material to write them on. As cardboard, however, would not permit of manifolding, a machine had to be devised which would get over the difficulty.

The cards are printed in sections of three, and are started through the back carriage, then through the second to the first. They are so printed that the writing comes into proper register on each card.

Notwithstanding the strain which it may be thought the fingers would have to bear in typing three pieces of matter at once, it is nevertheless stated that the machine works quite easily, the tension hardly varying from that of a single machine.

The peculiar form of shaft on the Smith-Premier renders this feat of mechanism not only possible, but easy, although it is hard to see how the same ends could be effected on any other make of the typewriter at present on the English market.

Travis. A machine of this name was placed upon the American market some years since, but very careful inquiry on our part has failed to elicit any details beyond the facts that it was a ribbon machine, and that it was run by a corporation calling itself the Travis Typewriter Co.

Typewriter Trust, The. The typewriter trust, about which so much has been said and so little known, was incorporated at Trenton, N. J., March 30th, 1893, under the name of the Union Typewriter Company. The

capital stock is $20,000,000, of which $4,000,000 is seven per cent. first preferred accumulative; $6,000,000 is eight per cent. second preferred accumulative; and $10,000,000 common stock; $2,000,000 of second preferred being retained as treasury stock The Remington, Caligraph, Smith Premier, Yost and Densmore machines entered into the combine, and each of the old companies retained its former methods of doing business, under the direction of the officers and general board of the Trust. The following extract from the *Express* (London) of 17th February, 1903, will show the effect of this combination

"There is a typewriter trust in New Jersey," said a representative of the Yost Company yesterday, "with a capital of £4,000,000, which controls the five chief typewriting machines in the world"

"By means of this combine prices have been kept at a high level for thirteen years with the object of getting the best material and making the best machines.

"The trust has no direct representative in London, but the Remington, Yost, and other leading typewriter companies, though apparently rivals, were really all one family."

Victorieuse. The name in France of the Gardiner.

Victoria. The same machine in Germany.

Wanamaker. The New York Agency for the Empire is or was with the Wanamaker's Stores, and their name is frequently used, with or without the term Wellington, to describe the machine in their advertisements.

Webster. Mr. Joseph March Webster, of Liverpool, patented a machine, of which, however, we have no details sufficient to permit us to describe it.

Wellington. The name given to the Empire in the United States

The Williams Telegraph Typewriter. This machine is a modification of the No. 4 Williams, and was made to meet the special demands of telegraphists.

It has only twenty-one keys and forty-one characters, including the alphabet in capitals, numerals, punctuation marks, and the necessary signs for commercial work.

The simple construction and small number of keys makes this machine easy to learn and operate.

Telegraph forms are easily inserted and feed quickly and automatically out of the machine when the work is completed. A continuous roll of paper can be used if desired, and for taking long despatches in newspaper offices, is

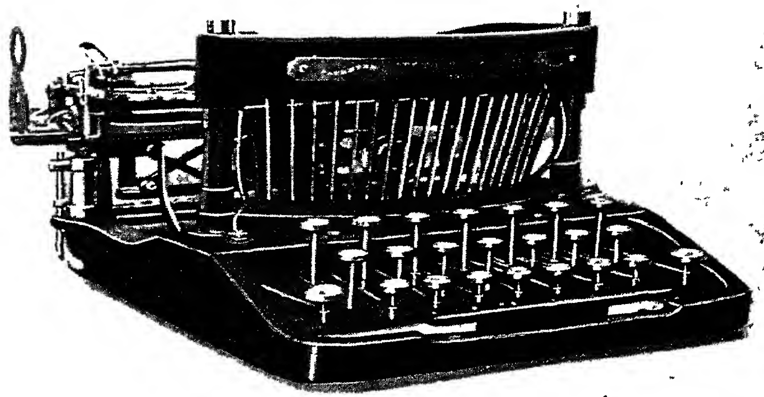


Fig 208

likely to prove a great convenience. This machine will make clear carbon and stencil duplicate copies, and is particularly desirable for writing cards and labels.

Wirt's Typewriter. This machine is designed to write music as well as ordinary writing. In order to obtain this result 280 musical signs and letters are engraved upon a prismatic cylinder, and these can be used by means of twenty-eight direct-acting keys, shift-keys, and a shift-drum, which latter is also operated in the newer type of instruments by means of a shift-key.

The type cylinder has the form of a sixteen-cornered prism, is mounted on a horizontal axle, and can be laterally moved on the same. It is also mounted on a slide by means of two supports, which are connected with two springs which make the drum return automatically to its central position after having moved sideways. The drum is therefore adapted to two distinct motions, the one being rotary and the other a sliding motion. When one of the keys is depressed the cylinder sets itself so that the sign which one intends to write comes opposite the striker, which presses the paper and the ink ribbon against the cylinder. The distance to which the cylinder will slide on the axle is set by pins counter-balanced by spiral springs, the pins stopping the movement of the shift-lever by entering into holes bored through the slide bar. When music is being written the cylinder will not only write the sign, but also

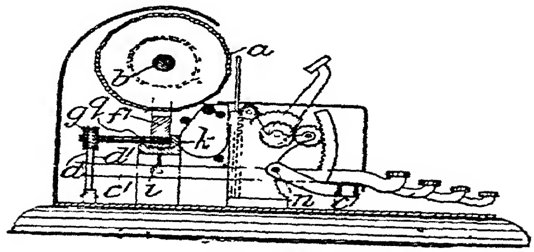


Fig 209

impress the five bars on the paper in such a way that when a sheet of music is copied it forms five distinct continuous bars. The shift drum is operated by means of a shift-key, and shows to the operator what signs he is actually writing; that is to say, whether he is using a quaver or semiquaver, etc., or ordinary lettering, or music and lettering combined, which latter quality should make it a boon to composers and musical authors.

As regards general appearance, the size of the instrument is the same as that of the ordinary typewriter, of which it has all the advantages as regards making carbon copies, speedy writing, etc. Of course, hand-copying and copying out of scores is done away with by this new machine, which has already gained, as we are told, a strong hold on the market.

World Flash Co., The, of Chicago, took out a patent for a machine which is stated to have resembled the Remington in many respects, but that instead of the depression of the key causing the connecting wire to bring the type-bar into position for printing, the bar was set in motion by means of an electric current derived from a battery in connection with the machine. The World Flash does not appear to have endured, and certainly it never found its way to these realms.

Addenda.

The following additional figures illustrate the machines named :—

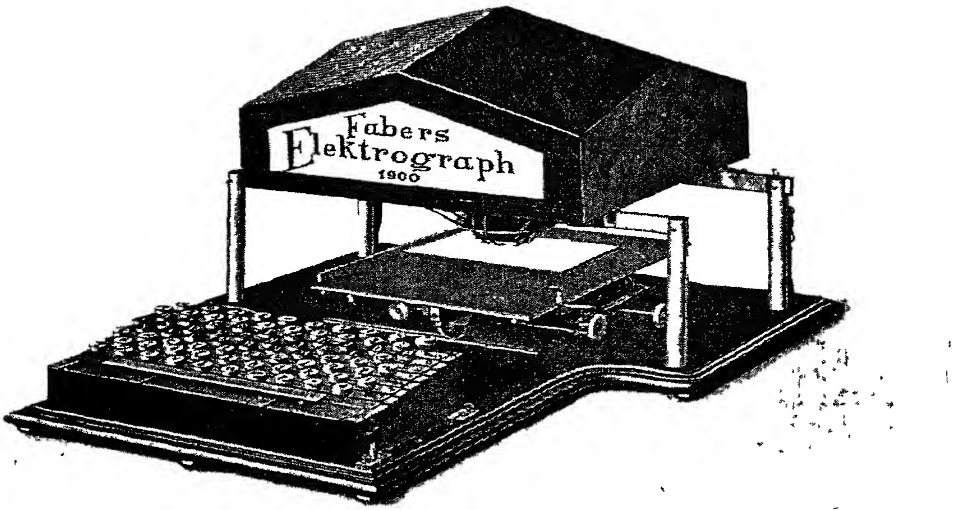


FIG 210.

Faber's Electrograph (see page 161).

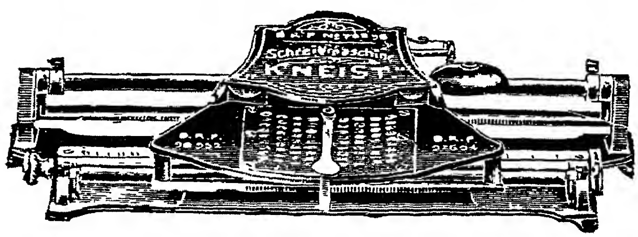


FIG 211

The Kneist (see page 233).

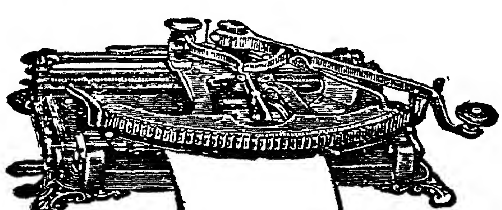


FIG. 212.

The Kosmopolit (see page 262).

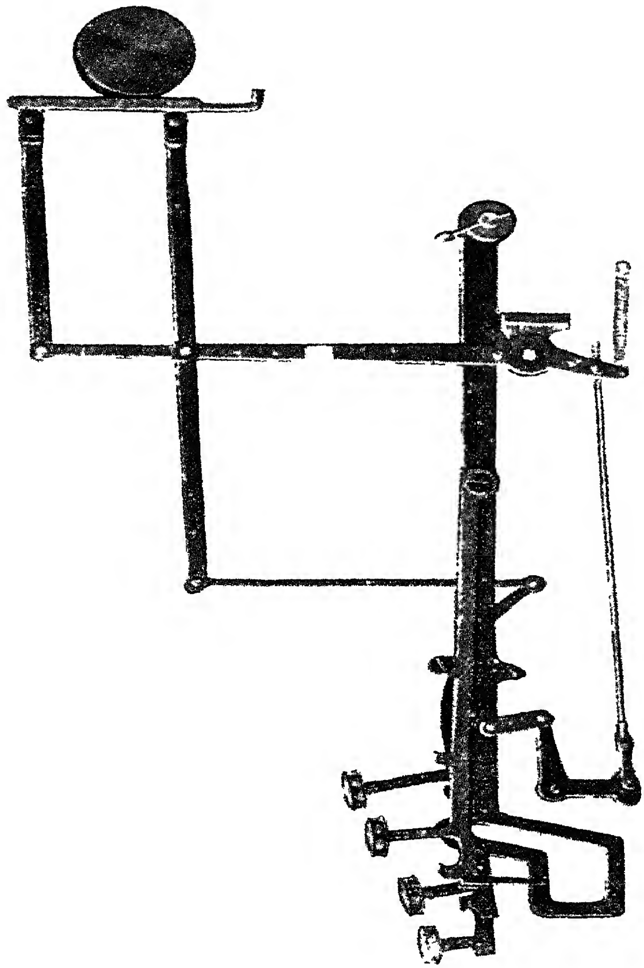


Fig 213

This illustration shows the type-bar of the Kanzler machine (see page 232). The four types are mounted on the front of the bar, very similarly to those of the Empire or Ford, and the depression of the key first causes the typeblock end of the bar to rise to the proper level, according to the character required, and then drives the bar home to the platen. In many respects, the action is like that of a typewheel machine. The impression formed on our mind was that, when thoroughly learned, the machine could be operated at considerable speed, but we saw nothing in the machine to justify its somewhat heavy price.

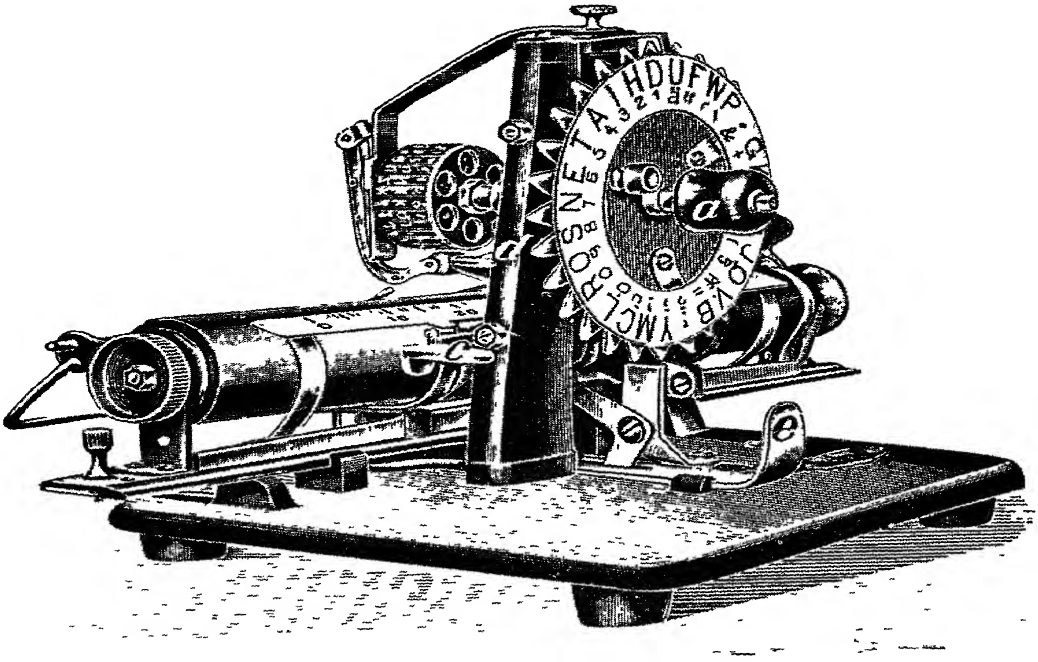


FIG 214

The Niagara (see page 252).

FIG. 215

The Regina (see page 236).

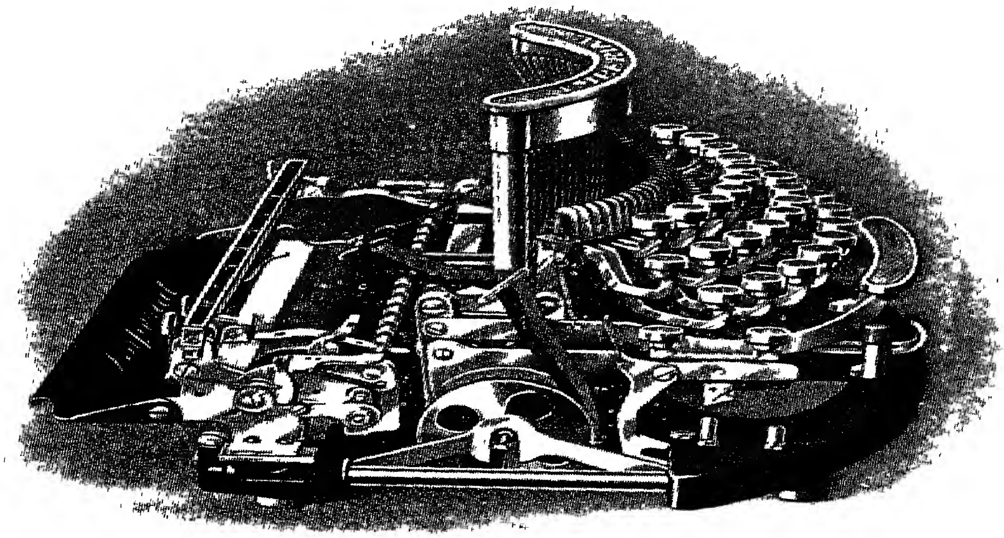


FIG 216.

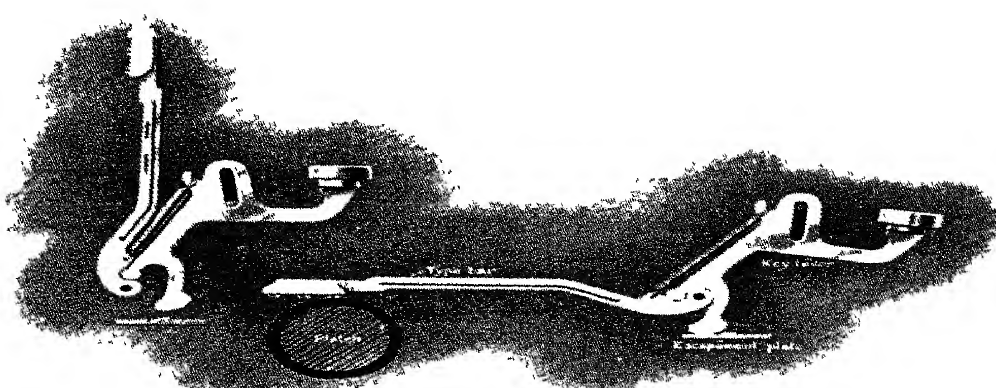


FIG 217.

The Imperial Typewriter.

This machine is the latest addition to the long list of claimants for public favour. It is an English-made typewriter, being the invention of Mr. Hidalgo Moya, whose earlier production is referred to on page 158.

As will be observed from the illustration, the Imperial is a machine of the downstroke variety, and its proper place would be immediately after the Franklin, which it closely resembles in appearance. The keyboard is arranged after the universal order, and works with two shift keys. It will be observed, however, that it is curved in form, and machines of this form of keyboard have not, hitherto, had a prolonged career. The Salter, which started with a curved keyboard, had to alter the shape, as did the first Williams. Another point to which attention should be drawn is the position of the ribbon spools. In prior machines of this class, the spools have been set down in the well of the machine. In the present case, they are set at the sides, so that, in passing from one spool to the other, a very considerable area of ribbon is exposed. Many machines make a special point of the ribbon being entirely protected. It will be observed that a bi-colour ribbon may be used.

Perhaps the most important feature of the Imperial is the form of type-bar, which connects directly with the lever, a feature which was used in the English and the Franklin. In the case of the Imperial, however, the connection is arranged differently, and the use of the spring to return the type-bar to rest is an addition which was sadly lacking in those machines. Quoting from the catalogue "In the action of the key lever and type-bar it will be noted that one end of the spring is attached to the bar and the other end to the lever, and that it has a bodily movement, independent of its action as a spring. That is to say, both ends of the spring are attached to parts moving in the same direction. As one of these parts moves faster than the other the spring receives sufficient tension to return the parts it controls to their normal position. This not only allows the use of the solid push movement, but of a strong and durable spring. The advantage of the "contact" system is also well shown in the action of the foot of the key lever on the universal escapement plate —the plate which causes all the levers to actuate the carriage. This action is similar to that of the operator's finger on the space-bar. The type and keyboard are shifted for

capital letters and figures, and there are no delicate parts between the key and the type-bar. . . . The type-bars of the Imperial are guided in a hardened steel V independent of the type-bar bearing. Thus, when the type makes its imprint on the paper, the type-bar is held firmly both on its outer and inner ends."

The movement of the keyboard and types on the depression of the shift-keys will therefore be seen to be identical to that on the National. The machine certainly presents a handsome appearance, and the touch would, one conceives, be an exceedingly pleasant and easy one The weight is stated to be about 14 lbs. and the selling price £10.

CHAPTER XII.

The Typewriter in Telegraphy.

THE service which the modern writing machine and its many developments lends to the telegraphic system in all parts of the globe is so great, that no account of the typewriter, as such, could possibly be complete without some reference to telegraphy. In order to make our description clear, it is necessary to explain, although in the briefest possible terms, the theory of the telegraph, as without such explanation, non-technical readers of this work would not appreciate the various details which follow.

It is, however, not our intention, in this volume at any rate, to dilate largely upon the history of printing telegraphs. So extensive a subject requires altogether separate treatment, and would be unjustly served, were it cramped into a single chapter such as the present. But we give so much of the subject as will convey a fair idea of the present position thereof, and as will enable the student to see the vast future before it, as well as the almost indefinite scope which the modest typewriter may be made to cover.

The principles upon which the telegraph act are fairly simple. A coil of wire being bound round a piece of soft iron, charges the latter with electric force when connected with a suitable battery, and converts the iron into a magnet. This magnet has the power of attracting to itself a steel needle, or indicator, which is so hung as to swing freely upon a pivot. And it will be quite clear that by varying the direction of the current, the direction in which the needle swings can be correspondingly varied. By the number and direction of these swings, a code is arranged, which will permit of messages being spelled out letter by letter.

As the operator, in order to read these messages, will require to keep his eyes fixed upon the needle, it is clear that he will be under some disability in committing the message to paper. To avoid this, devices have been introduced which cause a small hammer to strike a kind of anvil, or gong, and the operator is thus able not only to devote his sole attention to transcribing the message as it is received, but he can read the sounds much more readily, and with far less liability to error than in the previous case.

It will be perceived from this, that there are two distinct operations in sending a telegraphic message, namely, the act of transmitting, and act of receiving. Since the duration of time required to transmit a signal from one end of the line to the other is infinitely small, the only limit to the speed of transmitting is the power of the operator to send the electric pulses from the one end, and that of the receiver to read them at the other. It is in connection with these two operations that the typewriter, or rather the principles upon which the typewriter is constructed, come into operation.

The reader will understand that when the handle of the transmitter is moved to the right, the needle moves the same way, and is represented by the mark \ , whilst a left movement is shown by /, so that a movement, first to the left and then to the right represents a ; one to the right and three to the left means b ; right left, right left means c ; right left, left is d, and so on.

If, in place of a movement to the left we use a dot, and instead of a right stroke we use a dash, we still have the same alphabet in another form, thus, . — a, — . . . b, . — . — is c, . — — is d, and so on.

The Morse Receiver prints the messages received according to this dot and dash alphabet on a narrow strip of paper. This saves the labour of one attendant in reading the messages, but beyond this does not facilitate matters at all. To do this another device, called a puncher, is used. In this machine there are three keys. The operator works these keys, in precisely the same manner as though he were turning the handle of the dial instrument, a tap on the left hand key punching the equivalent of a dot in the narrow tape, and one on the right hand key acting similarly with the dash, whilst the middle key is used as a spacer, to carry the tape gradually onward

The tape, so perforated, is then sent through a transmitter, and is recorded by the automatic receiver, and transcribed in the usual way.

Now it will be clear that if, on the one hand, means could be provided whereby the proper perforations in the tape could be made in the tape by the simple act of depressing a single key, instead of tapping it out a mark at a time, much time and labour could be saved. And, moreover, if when the message was sent over the wire, it could be typed in ordinary characters instead of dots and dashes, then also the risk of mistranslation would be avoided, and the time occupied in that operation would be saved. And it is also clear, that time may be saved by the adoption of a simple code of spelling or telegraphic shorthand, in the same way that press work is generally executed.

Many means have been adopted to secure these ends, and nearly every one differs widely from the others. Those which we now describe are probably the most important and interesting, and bear most closely upon the subject of the typewriter, and are therefore chosen for our present purpose.

Very shortly after the electric telegraph had been brought into operation, Mr. R. E. House, of Vermont, U.S.A., brought out a printing telegraph, which, under favourable conditions, could transmit forty words per minute, whilst the best operator under the old style could not "do" more than half that speed. Notwithstanding this remarkable increase in facility, the House instrument was abandoned between forty and fifty years ago, whilst the method it was intended to supersede has remained "in full force and virtue." The chief reason for this extraordinary state of things has been stated to have been the inability of House's machine to work over long distances, a fact which also accounts for the early demise of many another promising invention in the same direction. In the House machine, there was a small wheel with the letters of the alphabet cut on the rim, and this wheel moved round step by step by means of electric impulses until the right letter was brought opposite the printing point, when the impression would be made. For A there would be one impulse or step, for B two, and so on, until Z, which required twenty-six impulses, in order to move the wheel round that number of steps, the average number of impulses being twelve per letter.

In 1855, David E. Hughes, of Kentucky, brought out a machine, in which he made use of the principle of synchronism, that is to say, he kept a wheel revolving in New York at the rate of about two turns per second, and another at Boston at precisely the same speed, and he so arranged

matters that these two wheels pointed in the same direction at exactly similar times, so that when a signal was sent over the wire from New York on the wheel pointing in any required direction, the Boston wheel also pointed that way, and printed the desired letter This method required only one impulse per letter, and worked well over very considerable distances, but the difficulty of maintaining perfect synchronism was found to be very great. However, it continued to be in use for a very considerable period, and although inventions innumerable were made, the Hughes machine continued until quite recently to be the only really successful long distance printing telegraph in use. The French government adopted it in the year 1860, and all over Europe (to which continent its use is now practically confined) it long remained the standard instrument. It printed its messages on long strips of paper, which were cut up and mounted on forms, and many readers of these pages have, no doubt, received or seen specimens of its work.

Telegraphic Shorthand. In order to facilitate the transmission of telegraph messages, a very ingenious code was invented some twenty years ago, by Mr P Phillips. Since then it has been enlarged and improved until it now contains more than two thousand expressions These expressions vary in length from one letter or figure, to groups of five letters. They stand for one word or for phrases composed of as many as eight or ten words. Its utility for press work became evident upon the introduction of the typewriter. An average operator sending unquoted matter can outpace the very best receiving operator taking it in manuscript; but almost any typewriter operator can take that kind of stuff with ease. The use of the code brings the speed of the sender more nearly up to that of the receiver, and the time saved in transmission is about one-third.

For almost all the code expressions employed there is an apparent reason for existence, orthographic or phonetic —or otherwise. Thus, *ofs* is easily understood to mean "office." The phrases, "shot and instantly killed," "it is reported," "Supreme Court of the United States" and "President of the United States" are coded by using the first letter of each word; but why *ckx* should indicate "committed suicide" does not appear. There are some other arbitrary signs in the code, such as *hag* for "in consequence of" and *kaw* for "adjourned sine die," but these

are quite limited in number. The code is arranged generally with a view to burdening the memory as little as possible. Expressions for words having the same root vary only as to termination. For instance, " receive " is coded *rc*, naturally then, " receiving " is *rcg* ; " received " is *rcd* and " reception " is *rcn*. Thus also, starting with *oj* for " object," we have *ojd*, *ojg*, *ojn*, *ojv*, *ojl*, for " object-ed, ing, -ion, -ive, -ionable "

Nearly every letter in the alphabet is employed singly as a code expression ; thus, *f* for " of the," *g* for " from the," *j* for " by which," etc. The figure 4 means " where ; " 5 " that the " ; 7 " that is " and so on.

The Telescriptor. The telescriptor was invented about 1896 by M. Hoffman, and is composed in principle of a typewriter furnished with electric contacts under each key, so that instantaneous currents can be sent into a line when each is depressed. These currents actuate a polarized electro-magnet which, in its turn, controls the escapement of a clockwork arrangement. On the axis of this clockwork are a brush that sweeps over a fixed current-distributor with twenty-eight contacts and a type-wheel. The latter is a disc on whose circumference are engraved in relief the letters of the alphabet, the digits, and various signs. It has, in all, fifty-six divisions, of which four are for letter-spaces and four for figure-spaces. A little paper band, for receiving the impression, passes in front of the type-wheel, on a movable drum, which is placed at the end of an oscillating lever under control of a special electromagnet.

We cannot do more here than give the general principle of the machine and indicate its applications. The telescriptor can in the first place act like a simple type-writer. Suppose two subscribers who have each a tele-scriptor. The calling-operator first presses down the two levers at the left above the keyboard of the machine ; the other operator presses down only the first of the two levers. The two machines begin to work at once by the aid of the intermittent currents sent over the lines, and the clock movements start. The operator touches the keys exactly as if he were writing on a typewriter, and at the same time a series of letters forming words are impressed on the strips of paper that unroll both under his own eyes and under those of the receiver of the message. In the telescriptor the same letter cannot be printed over itself ; a single letter is printed at each impression. Besides,

the strip advances by a constant and regular amount every time that a letter is printed. The letters thus cannot be spaced too widely, nor can they crowd upon one another.

The change of the receiving typewriter into a transmitter is very easily accomplished ; all that is necessary is to give a special signal at the end of the communication. The first operator raises his second lever while the other depresses his, and thus the transmitting machine becomes a receiver and the receiver a transmitter.

The device can then be worked by a simple telegraph ; if it is left as a receiver, we shall find, on returning from an absence, the different messages that have been sent printed on the strip. It should be added that the machine can write about 120 letters a minute. The telescriptor can also be combined with the telephone ; the same wire can serve for both, and may be used for either telephone or telescriptor by means of a simple switch.

The Essick Machine. Another wonderful machine is the Electric Typewritten News Bulletin. The bulletin itself is a sheet of paper, about five or six inches wide and miles long. But for convenience sake, it is cut into strips about six or seven feet long, and pinned to the bulletin board. On these bulletins is given the news of the world, weather everywhere, war news, news of movements of the Royal Family, but principally financial news.

All this news is typewritten before your very eyes on a machine, that stands in a glass case not far from the bulletin board. It is typed by unseen hands, and the strip of paper, thus written, flows automatically out of the machine, until there is a strip long enough for the attendant to tear off and pin to the bulletin board.

That machine is owned by a news bureau, and by an operator in that bureau—perhaps three, four, six miles away—the news is typed. Every time the operator presses one of the keys of his typewriter, that same letter of the alphabet is registered on perhaps forty or more bulletins in the different hotels and clubs, etc., in different parts of the city. The operator's machine, and the forty other machines are connected, of course, by electric wire, and thus the news is transmitted. Each message thus transmitted is practically a little telegram.

This machine is the invention of a Mr Essick. He was a very poor young man, but now, in middle life, is rich beyond the dreams of avarice. "I know Mr. Essick well," says a recent writer, "and have often been a guest at his house

at Yonkers, in the State of New York—for Mr. Essick is himself an American. While talking with him in his library on one occasion after dinner, Mr Essick told me the following romantic incident that changed the current of his life and led on to fortune.

"One evening years ago," he said, "I was walking along a street in Brooklyn, carrying a model of my electric typewriting machine. I was weary and discouraged, for the machine represented my life-work, and I had not succeeded in finding a capitalist to put it on the market.

"Suddenly I stubbed my toe, and my bundle, my precious model slipped from my hand and crashed to the pavement. Heart and soul sick, I was about to drag on, abandoning the model on the spot where it has smashed to bits.

"'You have dropped something, sir,' said a passing stranger, stooping and picking up my shattered model.

"He handed the wrecked thing to me, and I gathered it apathetically under my arm We walked on together, and as the stranger plied me with inquiries concerning the model for which I seemed to care so little, I explained the invention to him.

"And—here's where my story sounds like a romance—the stranger proved to be a capitalist and a newspaper publisher. Not much more need be said. That stranger proved to be the best friend of my life. He then and there declared that if I would repair the model, he would have several of the machines made, and would give them a full trial in connection with the transmission of news for his newspaper.

"To-day, the operator in the office of a news bureau —in New York, London, Paris, Berlin, wherever the machines are used—simply by pressing one of the keys of my machine, typewrites a telegram on a similar machine miles away Financiers, especially, depend almost entirely upon my machine for news to guide them in their operations"

Barclay's System. There is now in use by the Western Union Telegraph Company of America, a new method invented by its assistant manager and electrical engineer, Mr. John C. Barclay, which is showing such satisfactory results, that in the course of a few months, it is stated, it will be employed on all the big trunk lines of that service. In Mr. Barclay's system an operator simply strikes off the message on a typewriting machine, which is electrically connected with another typewriter at the receiving end,

and the letters, with exact spacing and punctuation, are reproduced there precisely in the form in which they have been sent.

This naturally simplifies telegraphing a great deal. There is no preparing of the message for transmission, while the receiver merely has to take off the printed slip from the machine. It is convenient for the public, for handwriting sometimes leaves room for doubt in the meaning of a telegram. It seems to be one of those reforms which the public would welcome with enthusiasm, and although at first it might displace some of the present operators whose skill would not be required, it would in the end lead to a much wider use of the telegraph, owing to the economies which would be effected. That is, of course, looking ahead, for the appliance has only just begun to be used.

It has so far been employed on the New York-Buffalo service, a distance of 445 miles. Shortly it will be working at the New York-Chicago service. The question which is naturally asked is: What is the distance over which it can be used? There is no reason to suppose that it could not be employed at as great a range as the Morse system, but that point has not yet been put to a practical test. In the present method it is not found advantageous to transmit messages further than 800 miles direct, for although they can be sent, as submarine cables show, infinitely longer distances, their rate of travel becomes so much reduced that it is better and quicker in the end to have repeaters at distances of not more than 800 miles. Probably the typewriter-telegraph may be found perfectly practicable for submarine cable transmission, but it will then work slowly, as other systems do. It is claimed that the operators at present have done as much as 100 words a minute. Their speed will depend not on the machine, but on the operator. It is a very skillful typist who can touch a 100 words a minute, and probably in practice it will be found that, taking one message with another, and leaving special circumstances out of account, such as codes, abbreviations, and the like assistants to speed, fifty words will be a good working average, much the same as that of the present operators. The advantage will, however, lie on the side of the typewriter, for he has only one key to touch for each letter, even though he has an infinitesimal loss of time in finding that letter, while the Morse operator has to make two or more motions of his key for each letter

The Burry Page-Printing Telegraph. The ingenious machine which forms the subject of the following remarks

is a very successful attempt on the part of John Burry, of New York, to substitute a true page-printing telegraph in place of the old ticker with its messages written upon a continuous tape.

According to the *Scientific American* the objects aimed at in this invention may be broadly summed up under the following three heads :

First : To produce a machine that would receive a telegraphic message and print it in the Roman alphabet, not, as in the old "ticker," in a continuous line upon an endless strip of tape, but in presentable page form, suitable for commercial or domestic use.

Second : To provide a machine which would be absolutely automatic, and, therefore, independent of both the sender and the receiver, thereby obviating all risk of clerical errors.

Third : To provide a system whereby a large number (several hundreds, if so desired) of these machine could be operated at one and the same time by a single sender at the central station.

Broadly stated, the system consists of a transmitting machine at the central station, from which, by the operating of a keyboard, certain electrical impulses are sent out, in the proper sequence and of the proper polarity, over two line wires, to any number of printing telegraphic machines. As each key of the transmitter is depressed at the transmitting station, electrical impulses are sent out through the circuits and act upon a series of magnets in each of the receiving instruments, the magnets serving to furnish the energy for the automatic movements of the machine.

The operation of the printing-telegraph, so far as its internal mechanical movements are concerned, is absolutely automatic, and hence, to all intents and purposes, the operator at the transmitting station, who may be some hundreds of miles distant from the printing telegraph, is able to print, without any possibility of error, a hundred different messages, in as many different and widely separated localities.

The machine consists essentially of a base and two end frames, in which latter are journaled the various shafts and spindles, and upon which are carried the five magnets and the numerous pawls and levers, by which the various movements in the machine are performed. A roll of blank paper, $5\frac{1}{2}$ inches in width, is carried upon a roller, with a steel centre, journaled at about the mid-height of the frame.

It is maintained under a constant and even tension by means of two toothed wheels, one at each edge of the paper, the paper being pressed down upon the serrated periphery of the wheels by two small pressure rollers. The toothed wheels, are maintained under constant tension by means of a winding gear, which is operated by a magnet acting through an arm. As this arm oscillates a knife edge on its upper end strikes a small pinion at the foot of the shaft, on which is a flywheel, and causes it to spin, a worm above the pinion on said shaft engaging the worm wheel, and winding up the shaft on which this worm wheel is journaled. Upon the shaft, between the toothed wheels, are two helical springs, which are wound upon the shaft with sufficient friction to cause the rotation of said shaft to exert a rotational effect upon said toothed wheels, thus preserving a constant tension upon the paper. This tension is resisted by two pawls, which engage a toothed wheel, keyed firmly upon the steel shaft that carries the roll of paper. The pawls are operated by the pulsations of the magnet, and are brought into play whenever a new line is to be commenced, the releasing of the wheels allowing the paper to be unwound a quarter of an inch, which is the space between two successive lines. This escapement is provided with ingenious mechanism to compensate for the decreasing diameter of the roll of paper; for it is obviously necessary that the escapement wheel should rotate through a larger arc when the roll is nearly exhausted than it does when the roll is full; otherwise an even feed of a quarter of an inch could not be maintained at all times. The compensating gear consists of a curved wire, one end of which rests upon the roll of paper, while the other is attached to a vertical sliding bar, at the centre of which is carried a horizontal stop-piece. When the paper is to be drawn forward, one stop is released and another engaged, the amount of rotation of the escapement wheel being determined by the distance between the inclined face of the arm, which carries the escapement pin, and the opposing face of the stop-piece. By this arrangement it will be seen that as the roll decreases there is an equivalent increase in the amount of rotation of the escapement wheel at each release.

The type-wheel is a small disc of brass with the alphabet cast in soft rubber around its periphery. This wheel is capable of rotation, oscillation and lateral or transverse motion. The ink roller, is carried on an arm of the carriage, and is inked every time it passes the ink-brush of the ink

tank. Under the constant tension of the mainspring, the type-wheel tends to rotate in a constant direction, but is controlled by the escapement wheel, which is operated by the magnet. The escapement is so arranged that a single pulsation of the magnet causes the type-wheel to rotate through the space of two letters. Thus, if the type-wheel is to be rotated through the space of six letters, there will be three pulsations of the magnet, three teeth of the escapement being allowed to pass. When this has occurred, the wheel is brought up in its approximate position, or midway between any two letters, and it is now necessary to move the type-wheel to the right or left just half a space, or 1-72 of a revolution, in order to bring the desired letter to the exact position of printing.

The transverse motion of the type-wheel across the machine is accomplished by means of a cord which is attached at its centre to the type-wheel carriage, and extends parallel with the guide bar, passes over two small pulleys at the end of this bar, and is wound at each end on two drums. The drums are rotated by means of the ratchet wheel and the pawl at every pulsation of the magnet, each movement of the ratchet causing the type-wheel to travel transversely the space of one letter.

The printing done by this most ingenious little machine is remarkably even, and in its spacing and general typographical excellence it compares favourably with the best work that is turned out on the typewriter.

The Murray Telegraphic System. An exceedingly interesting method of telegraphic typewriting has been invented by Mr. Donald Murray, M.A., who uses as the base of his system the Bar-Lock typewriter. In the form in which it has reached its final development the method consists of a group of machines at each end of a telegraph wire. The message is perforated in a narrow paper tape, which is then run through an automatic transmitter, which, in its turn, sends signals over the wires corresponding to the holes in the paper tape.

These signals are transmitted over the line at a speed sufficiently high to permit the transmission of the messages punched by several operators over one telegraph line. At the receiving station an electrical perforating mechanism under the control of the transmitted signals makes an exact reproduction of the transmitting tape. This received tape then runs into the automatic typewriter or "printer," which prints the messages in ordinary typewriting in page form under the control of the perforated receiving

tape, somewhat after the fashion of a mechanical piano. The speed of the printer is now very high, not less than 150 words (900 letters) a minute, but practical considerations of durability and maintenance of the typewriter, limit the speed at present to about 100 or 120 words a minute. The limit of speed in transmission of the signals over the line is in the receiving perforator which reproduces the tape at the distant station. With the improved machinery now in use, it has recently been found possible to punch the received tape faultlessly at the rate of 184 words (1,104 letters) per minute. At this speed no less than ninety-two holes per second have to be punched in the paper tape successively by a single punch. A similar group of machines in the reverse order are required for transmitting messages in the opposite direction on the same wire at the same time It was a model of the printer, at that time in a very crude form, that Mr. Murray took to New York in 1899. In New York the electrical portion of the system for perforating the tape, transmitting the signals and perforating the received tape, was evolved. At that time the printer appeared to be a sort of combination of sewing machine and barrel organ. An operator had to work the printer by turning a handle, and the machine was variously known as "Murray's coffee mill," and "the Australian sausage machine," but more frequently as "the Baby." In London the printer was very greatly improved. An electric motor to drive it was provided, and all the actions were made automatic, the machine stopping at the end of each line, running the typewriter carriage back, turning up a new line, and starting again, and finally stopping at the end of each message, all under the control of the perforations in the paper tape. A very necessary improvement was a method of invisible correction of errors in the transmitting tape. With the system in its now perfected form, if an operator on one of the keyboard perforators at the sending station strikes a wrong key or perforates a wrong word, all he or she has to do is to press a back-spacing lever and a "rub-out" key once for each wrong letter. This action punches the erroneous portion of the tape full of holes so as to obliterate the wrong letter or letters. This obliteration is reproduced in the receiving tape at the distant station, but the printer is so arranged that it stops work for the moment during which the obliterated portion of the tape is passing through it. The result is that no trace of the error, not even a blank space, appears in the printed message.

The system has been in steady commercial use for about three years between London and Edinburgh, and a circuit is now being equipped with Murray apparatus between London and Dublin. For about eighteen months it has been working between Hamburg and Berlin. An installation has been set up between St. Petersburg and Moscow. An installation of the apparatus for Calcutta-Bombay (1,200 miles) is now approaching completion and arrangements are being made for a staff of Murray experts to go out to India to instal the system. A set is nearly finished for working between Vienna and Prague, and arrangements are also being made for manufacturing Murray apparatus to equip several other circuits.

It may be mentioned that Mr. Murray has been engaged by the British Post Office for a term of years to invent and develop some new printing telegraphs to suit special conditions. Mr Murray points out that this engagement is in accordance with a tendency that has become very marked of recent years.

Creed's Telegraphic System. Mr. F. C. Creed, of Lenzie, in Scotland, has also invented, and is now perfecting a series of three machines having similar objects, and from an account of the system in a Glasgow paper we learn that, although other inventors have produced instruments which aim at results somewhat similar to those achieved by Mr Creed's Perforator, Receiver and Printer, yet they labour under this disadvantage, that they deal with a perforating alphabet entirely different from the Morse, which is used in the Telegraph service of the United Kingdom. Mr. Creed has endeavoured to adapt his machines to the Morse alphabet, and has succeeded in doing so.

After many years of labour, Mr. Creed succeeded in producing the perforator, which is now being tested in London. It is operated by means of an ordinary typewriter keyboard. When the lettered keys are touched they perforate a corresponding Morse letter on the paper tape. The speed with which this is accomplished is about the same as that attained in ordinary typewriting, and as this is double the average speed of ordinary punching, the new perforator can perform the work of two punchers. The tape perforated after the new fashion may be put into the Wheatstone transmitter at the London end of the wire and received at the other end in the manner at

present vogue, or advantage can be taken of Mr. Creed's new receiver, which reproduced at the end of the wire a perforated instead of an inked tape, identical in all respects with that put into the transmitter at the London end. This machine is necessarily more complicated than the ordinary Wheatstone receiver, and does not work at such a high speed. At present a Wheatstone receiver can carry at the rate of—according to the condition of the wire—from 250 to 350 words a minute. But the maximum speed as yet attained on Mr. Creed's new receiver is a little over 150 words a minute. Then comes the third of the inventions. When the tape thus perforated passes through a machine which actuates an ordinary typewriter in accordance with the perforations which play the part of human fingers usually applied to the keys—something after the fashion of the Jacquard loom—and the perforated tape is turned into printed letters and words. No transcribing by hand is required. The typewriter is moved by means of a motor, and the "copy" is delivered in page printed forms. This has been accomplished on an experimental machine at the rate of seventy words per minute, but Mr. Creed expects to attain fully 100 words a minute, so that here the speed would be four times that of a longhand writer.

The Electrograph. A few words on this machine whereby pictures may be telegraphed may not be out of place in these pages. From a description written in 1902 by Mr. Donald Murray in *Everybody's Magazine*, we learn that the design or illustration to be transmitted is first of all reproduced as an ordinary half-tone illustration, of which many instances occur in these pages The plate is then flooded with melted wax, and then rubbed to a smooth surface. This fills the depressed portions with an insulating material, leaving all other parts smooth and clean. The plate is then bent around the cylinder of the transmitting machine, the operator closes his key, and the electric current does the rest.

The distant receiving machines have plain white paper wrapped around their cylinders. The closing of the circuit by the transmitting operator starts all machines at once, and in six to ten minutes the picture is completed

The automatic operation is really a very simple one, though the results are almost beyond belief. The transmitting stylus, a fine steel point, traces a spiral upon the zinc plate, while the wax dots, rapidly breaking the circuit,

cause electrical pulsations upon the connecting wire, which pulsations are recorded on the receivers by special electro-magnets actuating steel pens which trace corresponding spirals upon the recording papers. These spirals broken into dots similar to the waxed depressions in the zinc plate, build themselves up automatically and the pictures unfold gradually, being composed of thousands of dots. An exact copy is thus made of the zinc plate which in itself is a perfect half-tone of the original picture when completed. The transmitting operator then opens his key, stopping all the machines on the line. The electrograph is reversible, that is, the machine is either a transmitter or a receiver. The simple changing of a switch and substitution of a pen for the stylus makes the change. Sitting at his machine the receiving operator sees the face before him develop in a few moments from an imperfect outline to a human likeness which is startling. The effect is somewhat similar to the development of a photographic negative, pens acting instead of the chemicals.

The electrograph has been operated over lines ranging from a few miles to 1,100, portraits being transmitted the longer distance successfully. An idea of the value of the apparatus for news service can be gained when it is stated that the Washington correspondent of a metropolitan daily paper, for instance, can keep one wire "hot" with the text of an interview or an account of some sensational episode, while, by another, he is transmitting portraits of persons prominently concerned and photographs of scenes connected with the story.

Yetman's Transmitting Typewriter. This machine was launched upon the American market about the year 1903, and was the invention of Mr. Charles E. Yetman. Very great things were expected of the instrument, which took many years to invent and bring to perfection, but it had not a very extended commercial career before the Company which exploited it fell into difficulties, and before its affairs could be straightened out, the president of the Company was found dead under the most singular circumstances—it being, to this day, unsettled whether he fell by his own hand, or by that of the assassin.

The Yetman machine is a typewriter of the front strike variety, and the following description, quoted from *The Telegraph Age*, will convey a fair and accurate idea of its construction and scope.

The transmitting typewriter in size and general appearance is not unlike that of other typewriters of its class. As a matter of fact it is two machines in one ; a complete typewriter and a telegraph transmitter. When the machine is not in use it may really be said to consist of three parts, the typewriter, the transmitter and the keyboard. If the typewriter part of the machine is to be used, the depression of a lever at the right of the frame connects it with the keyboard, and when the work is complete the raising of this lever again disconnects it. If the transmitter is to be used the depression of a lever at the left of the frame connects it with the keyboard and opens the telegraph circuit ; the raising of this lever at the completion of the work of transmitting again disconnects the transmitter and closes the telegraph circuit. The typewriter and the transmitter may be connected with the keyboard at the same time by the depression of both the levers above referred to, so that a mechanically correct copy of the matter transmitted may be secured.

The machine may be permanently connected into a telegraph circuit by simply cutting the wire and inserting the two cut ends into binding posts fixed in the frame at the rear. Temporary connection into any circuit may be made by the use of a cord and jack placed under the spring of the Morse key circuit closer, so that the machine can be moved quickly from one wire to another like any ordinary typewriter.

The typewriter part of the machine has been subjected to the severest possible tests, covering a period of many months of practical work. In all of these it has proved itself to be superior to anything of the kind yet put upon the market. Every letter, every word and every line written is in plain sight from the time the first letter is struck until the paper has been removed from the machine. That this feature of "visible" writing is invaluable in a typewriter to be used for telegraph purposes, is admitted by all.

The carriage is returned by one direct downward movement of a lever at the right of the keyboard ; the line spacing is accomplished automatically at the same time by the same motion. The paper feed has been constructed with special reference to the rapid handling of telegraph blanks. The carriage moves upon ball bearings and the typebars, which are the real like of a typewriter, are connected into their hangers by ball bearings. The touch is

exceedingly light and is absolutely uniform in every part of the keyboard. It is not too much to say that the transmitting typewriter excels all others in speed, ease and uniformity of touch, permanence of alignment, manifolding and durability.

The transmitter part of the transmitting typewriter make it possible for a telegraph operator to transmit Morse signals which are absolutely perfect by touching the keys of the keyboard. The touch used is the ordinary quick staccato typewriter touch. Each Morse signal and the elements of which it is made up, namely, the dot, dash and space, are transmitted by the mechanism of the transmitter with absolute accuracy and uniformity, independently of the skill of the operator. The space between the signals, however, is entirely within his control, so that he can space the letters in difficult words more widely than in others and use that fine judgment possessed by all intelligent operators, which is absolutely inseparable from efficient telegraph work, and which it is asserted no mechanism will ever be able to supply.

The Zerograph. Wonderful as the previously mentioned adaptations of the typewriter may be, probably the most wonderful of all is the machine to which we now make reference, namely, the Zerograph of Mr. Leo. Kamm, of London. The apparatus consists in the main of a typewriter, which can be used for the purpose of receiving or transmitting messages, together with the general instruments which are used for the despatch or receipt of ether waves The most important, however, of all the apparatus is the typewriter portion, or Zerograph, as it is technically called. In general appearance the machine is not much unlike an Ideal-Hammond typewriter. The keys are contained in a circular row, and on the depression thereof, not only is an imprint recorded upon paper in the usual way, but they also transmit through the air two ether waves, which cause the distant receiving typewriter to record the same letters upon a paper tape, in manner similar to that of the Morse instrument already mentioned.

Though similar in working to the ordinary typewriter, the principle and mechanism are widely different. The type-keys are arranged in a quadrant, there being twenty-eight keys whereof twenty-six are allocated to the usual alphabetic purposes. There are, in addition, two shift-keys for figures, etc., and these also serve for spacing

purposes. The types are arranged on a type-wheel or quadrant, as in the earlier models of the Hammond, and move up and down on the post according to the depression of the shift-keys. On the depression of a key, the further end of the lever tilts up, and forces up a check-pin, which not only arrests the movement of the wheel, but also sets in motion the synchronizing arm, and the first impulse is sent to line. "This arm, which is the most vital part of the apparatus, and travels in a vertical plane, is operated from the axis of the circle, corresponding to the quadrant, and travels round the circular path until its progress is arrested by impact with the projecting check-pin of the depressed type key. The corresponding letter is then printed, and the synchronizing arm is then returned to its original or zero position by means of an electro-magnet." From this it will be seen that what in the Hammond is termed the driver-arm (that is, the arm which directs the movement of the type-wheel), serves not only its original purpose in the Zerograph, but also sets the synchronizing movement in motion, in manner not unlike in theory, but differently in practice, to the synchronizing gear previously mentioned.

It would be impossible, without a very lengthened explanation and the use of much highly technical language, to explain the method by which the various movements are made, but a fully detailed account may be seen in *The Scientific American* for October 17th, 1903.

This machine takes its name from the fact that after the depression of any type-key, the synchronizing arm must return to the normal point of rest, or zero, before another type can be printed, and for this reason misprints are rendered almost impossible. A speed of thirty words per minute can be attained by an operator after very little practice.

To apply the Zerograph to wireless telegraphy, it is only necessary to connect it to the usual apparatus utilized for that work, the typewriter being substituted for the Morse transmitter. To ensure satisfactory and successful operation, however, the inventor has also devised several special contrivances, such as an automatic coherer to enable rapidity in transmission and receiving to be attained, and other items.

The Zerograph is stated to be most favourably adapted to ether communication, owing to only two impulses being necessary to transmit or receive any sign.

In view of the possibility of developments of this machine, therefore, there would seem to be no reason why a man sitting at his Zerograph in London, may not, in the future, be able to hold written converse with his correspondents in the furthermost parts of the globe, without the intervention of any actual physical connection.

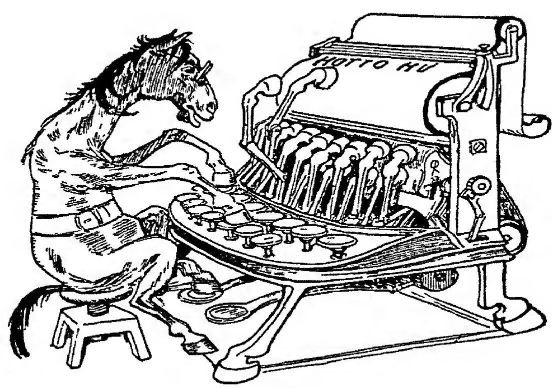


Fig. 1.

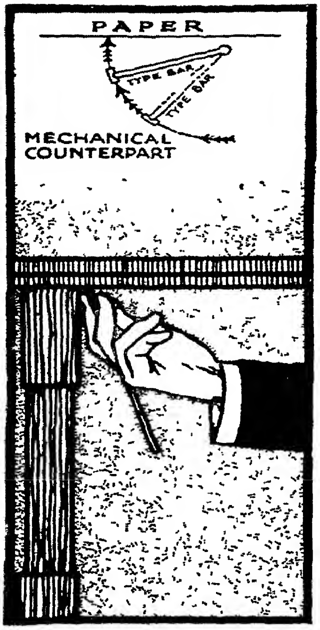


Fig. 2.

Fig. 3.

Would you write on the under side of a table (Fig. 1), or against a wall (Fig 2), or would you not rather write with greater ease and accuracy on the *top* of the table or any other horizontal surface (Fig 3)?

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